60th ANNUAL REPORT

OF THE DIRECTOR TO THE HON. THE MINISTER FOR AGRICULTURE AND FORESTRY

(As required by "The Sugar Experiment Stations Acts, 1900 to 1959")

BUREAU OF SUGAR EXPERIMENT STATIONS

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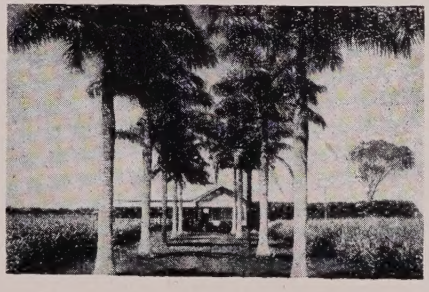
Q. 73, an erect high quality cane released for Mackay district during the year.

COVER

Palm lined entrance to the Southern Sugar Experiment Station. In August, 1901 the Bureau opened its Bundaberg headquarters. The present Station site was acquired in 1913.



Above —A Bureau conducted Junior Farmers' School shows interest in other uses for cane lands.

Left —Weedicide trials are being carried out for the control of Johnson grass.

Below —The effect of various dusts against yellow spot disease is being investigated.

Sixtieth Annual Report of the Bureau of Sugar Experiment Stations

To the Honourable the Minister for Agriculture and Forestry

Dear Sir,

I have the honour to submit the Annual Report of the Bureau of Sugar Experiment Stations for the year ending 30th June, 1960.

This sixtieth report of the Bureau outlines the work carried out during the period by the several divisions — namely, soils and agronomy, plant breeding, entomology and pathology, and mill technology. The operations of the four Experiment Stations are given in some detail and the sugar industry statistics collated by the Bureau are printed in their usual form. The introductory remarks contain brief reference to some aspects of the present situation within the industry, comments on the results of the 1959 season and the prospects for the 1960 harvest, and a general review of Bureau activities.

The Present Situation and Crop Control

Overproduction still casts its shadow over the industry and it is clear that the high yields of recent years are not due to a run of above average seasons, but must be regarded as normal production under present day conditions. The full impact of the greater yielding powers of the newer varieties, the benefits of pest and disease control, the availability of adequate and highly efficient mechanical equipment has now been felt for the past two seasons. Areas previously regarded as marginal and of doubtful production capacity are growing crops equal to those on what were originally considered to be better class soils. The extension of irrigation in the Southern district has removed much of the drought hazard and uncertainty of season. An immediate consequence of this latter is the fact that in the 1959 season two southern mill areas topped the State for production yields in tons of cane per acre. Admittedly the Lower Burdekin harvested a somewhat lighter than normal crop thus forfeiting its usual premier position, however, there seems little doubt that it will be necessary to take due cognizance of the yield potential of these Southern areas in the future.

The necessity to leave nearly 2,000,000 tons of cane unharvested in 1959 indicates the difficulty in equitably decreasing production. It should not be supposed that the warning given by the high overproduction which marked the previous year (1958) was ignored, for this was not so. There was indeed a determined effort by most growers to reduce their output but this was neutralised to a considerable extent not only by high c.c.s. but also by the excellent ratooning characteristics of present day varieties. There was a definite limit to the amount by which this could be offset by reduced plantings, as plantings must be made to maintain rotation for future production.

In addition the quality of many standover crops which had been surplus in 1958 was surprisingly good.

The crop that was harvested in 1959 was characterised by high c.c.s. values in practically all districts. This was well illustrated by the fact that, for the first time for many years, the average for the whole State showed that it took less than seven tons of cane to make one ton of sugar. This indeed was a remarkable achievement and emphasises the quality of present varieties. The outstanding example was the Mackay district where two mills finished the season with an average of just less than 6.4 tons of cane per ton of sugar. Performances such as these, though very desirable in themselves, added to the amount of unwanted cane that had to be left unharvested in the field.

It seems now that the problem of how to reduce the crop to the required limits will take some time to solve and in the doing of this some hardship must fall on all sections of the industry. It is unfortunately very difficult to distribute the reduction of grower income equitably, but the nettle must be firmly grasped and every effort made to reduce the surplus tonnages that are again in sight in some districts for the 1960 harvest. In one southern area, a preliminary estimate showed that well over 500,000 tons of cane appeared likely to be available when, in actual fact, somewhat less than 300,000 tons was required for the mill to obtain its peak. The destruction of such a large percentage of the standing crop is surely not an economic proposition. No one knows this better than the growers concerned and a remedy is being earnestly sought.

Hand in hand with the industry's strenuous efforts to bring its crop into marketable limits is its drive for decreased production costs *via* a greater degree of mechanisation in the handling of its raw material and its final product. With regard to the latter a major step forward is the fact that the fifth bulk terminal, that at Mourilyan, became ready for operation during the year and is now receiving the 1960 sugar from the Innisfail district. Perhaps never before in the history of the industry has the mechanisation of cane harvesting been subjected to such direct attack and financial outlay. A diversity of machines will be in commercial operation during the 1960 crushing. Of these, the behaviour of the Massey-Ferguson harvester-loader excites a great deal of interest. This machine breaks with tradition for commercial or near-commercial harvesters in Queensland by cutting the stalk into sections. Some eleven units will be operating on a full scale in several districts during 1960 and an endeavour will be made to decide the future of this machine which will necessitate such a major change in cane haulage should it be adopted.

An exhibit of varieties at a field day held at Yuruga, Ingham Line.

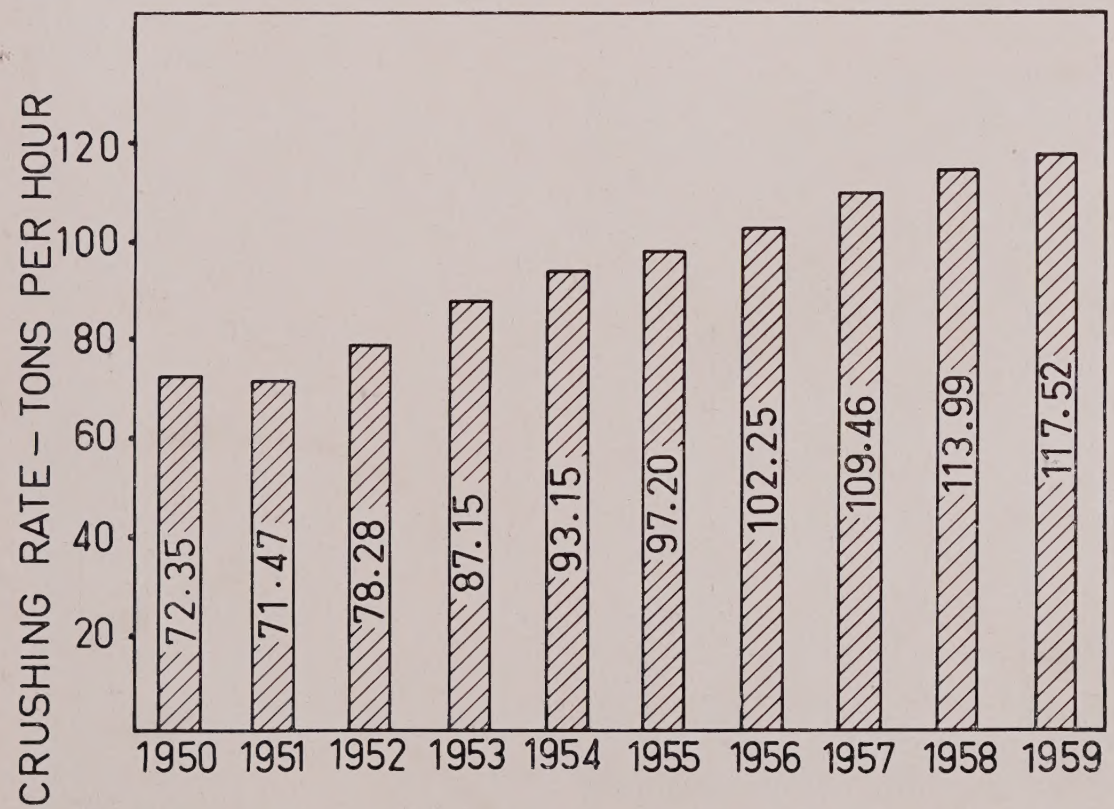
As might be expected the year under review has revealed a considerable amount of interest in alternative land use in sugar districts. The Bureau, in conjunction with other organisations, has assisted and encouraged interested growers in many ways. In the Ingham area, surplus cane plus the other foods required for a balanced ration has been used for cattle fattening. Lower Burdekin growers are developing, with a considerable amount of success, the possibility of producing commercial quantities of cowpea seed, for which there is a ready market. Cotton is finding a place on some of the irrigated cane farms at Bundaberg.

THE 1959 SEASON

The crushing season commenced at the far northern mills during the third week in June with the Mackay and Bundaberg mills starting about one month later. All mills were finished by 22nd December, 1959. The average length of crushing was 20 weeks, which was the shortest for eight years.

The cane crushed amounted to 8,427,731 tons, from which 1,217,020 tons of 94 net titre sugar was made. To confine the sugar output to the existing market approximately 88,000 acres of crop were not harvested, which left some 2,000,000 tons of cane in the field. Much of this had to be destroyed but some was left to standover for the succeeding crop. Actually, the harvested area of 299,732 acres was the lowest since 1952.

Of recent years it seems that but few seasons pass without a record of some kind being claimed and 1959 was no exception. The average figure of over 4 tons of sugar per acre for the whole State is the highest yet recorded. This is progress of a significant nature and must be



A steady increase in average crushing rates for Queensland mills. (Each average excludes the C.S.R. mills and Rocky Point.)

taken into account in planning future production. It is also ample confirmation of previously expressed confidence in the yielding capacity and quality of present cane varieties.

The 1959 crop was a good one from the manufacturing point of view and with high purity material coming into the factories at higher crushing rates the standards of both milling and processing surpassed those of previous years. As shown in the accompanying graph the average crushing rate for the State (excluding C.S.R. mills and Rocky Point) again showed an increase, from 113.99 tons cane per hour in 1958 to 117.52 in 1959. Factory performances also improved on the high levels that were recorded in 1958. The rises in recovery, boiling house efficiency and coefficient of work indicated that a high overall standard was maintained.

As is usual in this report an indication of the total throughput of all 31 mills at the peak of the season is given. For 1959 this was 429,692 tons of cane crushed during the seven week period ending 31st October, being 2,167 tons less than the corresponding figure for the previous year.

Q.49 has produced good crops at Bundaberg, but is being gradually replaced by better varieties.

PROSPECTS FOR THE 1960 SEASON

The crop available for the 1960 season appears to be again in excess of requirements. The Bureau's pre-season estimate, made at the end of May from figures forwarded from all mill areas, indicated that the tonnage for harvest would be 9,875,000 tons of cane from which could be manufactured some 1,382,000 tons of 94° net titre sugar. If the State peak of 1,214,600 had had to be adhered to, (and unless some drastic deterioration of crop occurred before the finish of the harvesting season) some 1,200,000 tons of cane would have been left unharvested. However, the Sugar Board's unexpected acquisition of excess sugar, as third quota, equivalent to 7½ per cent. of individual mill peaks will considerably alleviate the position. This welcome increase could represent some 600,000 tons of cane and will substantially reduce the amount that would otherwise have been left in the fields.

Some factors which might operate to further reduce the above estimate are the heavy flowering which has occurred in the northern areas and the dry, early winter in the south. This latter has been accompanied by some severe frosts but no appreciable loss of cane has been observed. However, at the time of writing this report there is little evidence of any substantial reduction from the preliminary crop estimate. The sugar content of the cane being harvested is, in general, in keeping with the forecast. In many cases it is higher than that for the corresponding period last year.

For New South Wales the anticipated crop for 1960 is 537,000 tons of cane from which could be obtained 66,600 tons of 94 net titre sugar.

BUREAU ACTIVITIES

Disease Outbreaks

The need for constant and unremitting vigilance in regard to crop hygiene was emphasised

during the year by the occurrence of certain diseases in areas in which they were previously unknown, or in which they had not been found for several decades. Perhaps the most startling was the appearance of leaf scald in the variety Q.63 almost simultaneously in the Mackay and Bundaberg districts. Although leaf scald was known in these districts many years ago it had completely disappeared from all the local canefields. Therefore, its re-appearance in this variety in both areas is a puzzle since it has not yet been possible to trace a common source of infection. The finding of chlorotic streak in the Inkerman area was unwelcome as the district was previously regarded as free from this disease. An outbreak of dwarf disease in the Farleigh area was traced to a transfer of apparently clean plants from a location that was previously affected.

In all these instances vigorous quarantine, roguing and destruction measures were immediately instituted by the Bureau with the assistance of the Cane Pest and Disease Control Boards concerned. One pleasing feature of this otherwise disappointing state of affairs was the ready co-operation of the owners of the affected farms. This disease-conscious spirit is an undoubted asset to an industry which is vitally dependent upon efficient crop hygiene.

Very much on the credit side of the disease control work is the report that for the first time since records have been kept (approximately 35 years) not one stool of Fiji disease was found in Queensland canefields.

Legislation Amendments

During the year the Sugar Experiment Stations Acts Amendment Bill of 1959 was enacted. The amendment of greatest interest was that which was designed to make more adequate provision for disease control. The amended sub-section in this regard is now more positive concerning the removal, planting, transplanting, or delivery to mill of any cane from a

The development of anti-lodging canes is paying dividends. Erect Q.66 and lodged Badila.

plantation within a quarantine area, contrary to the provisions of any Proclamation or Order in Council. Steps have been taken to rescind a number of Proclamations and to issue new ones in order to include leaf scald for the various Mackay and Bundaberg mill areas.

Four new "Q" varieties (Q.69, Q.71, Q.72 and Q.73) were placed on the approved list for 1960. This is adequate evidence of the increased number of selectable seedlings now coming from the stepped-up breeding programme referred to in previous Annual Reports.

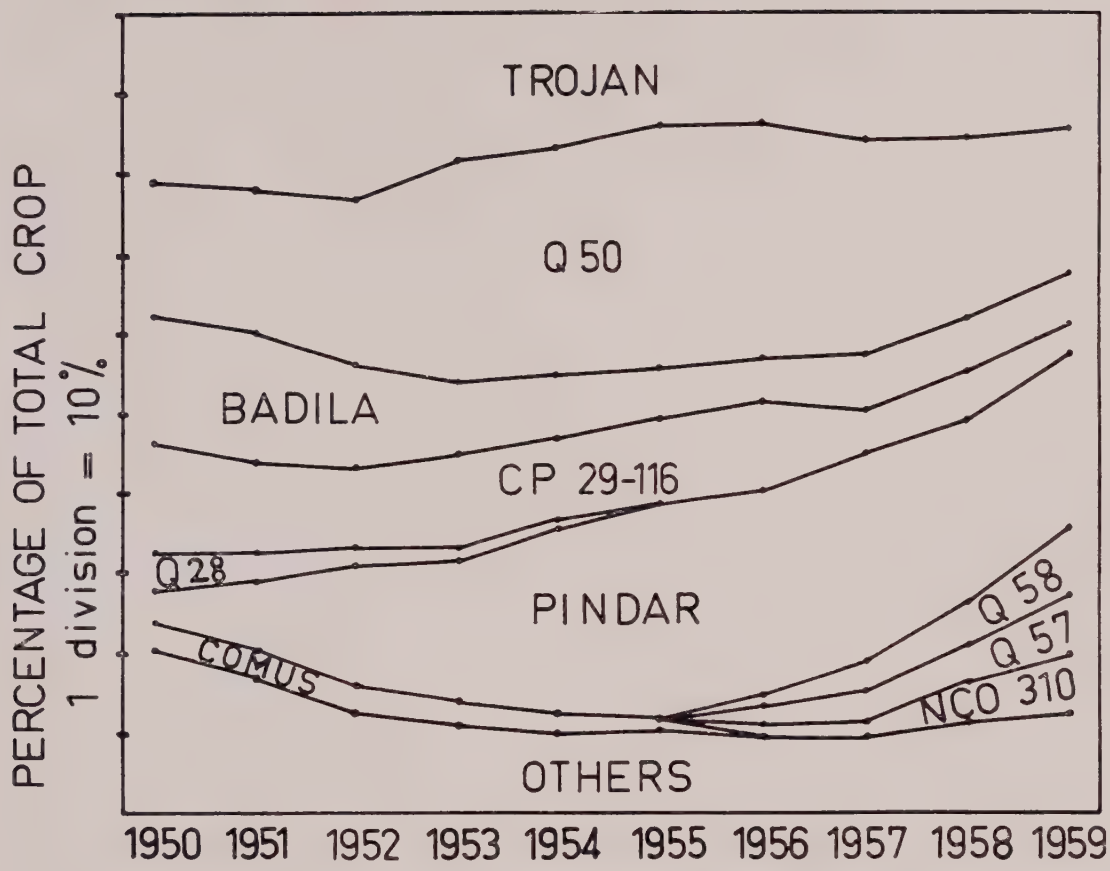
Of recent years particular attention has been paid to the development of anti-lodging canes and also those with high early sugar. Some excellent canes of the former type were reported last year and it is very pleasing to record that one of the canes released this year, Q.71, has outstanding early maturing qualities. To date its distribution is limited to the southern areas where it is demonstrating a sugar content at the commencement of the season which has not previously been equalled. This is a welcome asset to these districts of lower temperatures and slower growth rates.

Rise of N.Co.310 and Decline of C.P. 29/116 in Southern Districts

The 1959 harvest was the first for 14 years that C.P.29/116 was not the leading cane in any one of the four Bundaberg mill areas. This was also so at Gin Gin but not at Isis. C.P.29/116 which has done so much for the southern districts, first took the lead in the Fairymead and Gin Gin mill areas in 1946 by displacing the then widely grown Co.290. By 1947 it had displaced P.O.J.2878 in Qunaba, Millaquin and Bingera and it then occupied first place in all areas except Isis. The following year Isis growers also swung away from P.O.J.2878 in favour of C.P.29/116, and in this district it has held pride of place ever since.

With the passing of the years, however, N.Co.310 gradually took over from C.P.29/116 and at the present time it is the leading cane in most of these mill areas. This, most certainly is

Experimental plots on the Lower Burdekin Experiment Station.



Showing the contribution of the principal varieties to the total crop over the years 1950-1959.

a matter for considerable satisfaction, since there is no doubt of the improvement in quality it has brought to the early harvest of district crops.

It is of interest that these two imported canes, N.Co.310 from South Africa and C.P.29/116 from America, have competed so successfully with our locally produced varieties. It is also noteworthy that they followed two other foreign canes which previously held first place in the south, i.e. Co.290 — an Indian cane — and P.O.J.2878 from Java. This is in spite of the fact that, throughout the State, Queensland bred varieties now comprise 82 per cent. of the total crop. It is evident that there is considerable merit in the Bureau's practice of importing selected canes from other countries.

The time has also come for Isis growers to exploit more fully the higher quality varieties. Canes like N.Co.310, Q.50, and the newer varieties Q.69 and Q.72 could undoubtedly replace much of the C.P.29/116 currently grown in that district.

Wilt Disease in Velvet Bean

The growing of velvet bean as a green manure crop has become an established and most useful practice in practically all districts. A major reason for the popularity of this particular legume was its resistance to the several wilt organisms that persisted in many soils and which played havoc with plantings of the older type green manures. The occurrence of a strain of *Phytophthora dreschleri* in some areas in North Queensland is therefore a matter of some dis-

appointment since this organism induces a killing stem rot and a wilting condition which will completely destroy a planting of velvet bean. It was previously unknown in these areas and its presence today is undoubtedly associated with imported seed. Because of the severity of the attack it is no longer possible to grow velvet beans on the infected sites. Therefore it is indeed fortunate that the Bureau's cowpea selection and testing programme has rendered it possible to substitute improved types of cowpea for use on these areas. One of them — Malabar pea — has shown that it will produce an excellent crop over a wide variety of soil types in most cane growing districts.

The isolation and identification of the causal agent as *P. dreschleri* by the Pathology Branch is of considerable practical value. It is known that the cowpea is immune to this organism and therefore its recommendation as a substitute was made practicable.

Studies with Radioactive Tracer

Juice stability is an important factor in the factory and in consequence a knowledge of residence time and flow pattern within the subsider can be of appreciable significance. The Bureau welcomed the co-operation of the Australian Atomic Energy Commission in using the radioisotope, Bromine 82, to determine some characteristics of juice movement within the Bach subsider at Qunaba mill. The results indicated the possibility of such a technique becoming a useful tool in mill studies, and also that it could be used without danger, providing the recognised precautionary measures were adopted.

Rat Baiting Trials

Rat damage was again responsible for a considerable loss in cane tonnage, in fact, of all estimated losses due to pests that due to rats was the greatest. It was estimated that approximately 21,000 tons of cane were lost in this way. The seriousness of this pest should not be under-estimated. In times of heavy rat infestation the damage may be appreciably greater than that quoted above, for instance during a recent plague year the loss was set down as approximating 75,000 tons of cane.

Although Bureau trials with different types of baits and placement methods continue there is clear evidence of the need for further fundamental research into the habits of these pests and a continuation of the previous work of this nature.

Some District Comparisons

Figures from the 1959 crop are of interest. Perhaps the most outstanding is the fact that for the first time in many years the Lower Burdekin area yielded pride of place to other areas for the tonnage of cane produced per acre. As a matter of fact the Burdekin's average of just less than 33 tons of cane per acre was exceeded by four other mill areas, all of them in Southern Queensland. There were several reasons for the Burdekin's lower figures, chief among them being the effect of the cyclone in February, 1959, and the fact that most farms had much more cane in sight than could be harvested because of quota allotments. Therefore irrigation and fertilizing was intentionally restricted in an obvious desire to avoid unnecessary expenditure.

However, this does not detract from the excellent performance put up in the South, particularly by Millaquin and Qunaba mill areas which topped the State by producing 36.5 and 34.5 tons of cane per acre respectively. The intensive and efficient utilization of cultivated acreage in these districts is commendable and is in no small measure due to the extensive irrigation in these somewhat drought-prone areas.

As far as c.c.s. was concerned, the year was a good one for the Lower Burdekin which maintained its well-earned reputation for producing high quality cane. Nevertheless it was beaten in cane quality by five other mill areas and was practically equalled by one or two others. Most of these were at Mackay and there is little doubt that this latter district is now in the forefront as a producer of sweet canes.

Setting out an experiment with lindane for grub control.

Cane Analysis

As the major project of the mill technology research programme, the cane analysis investigations were pursued to the maximum extent. These investigations are now under the direction of the Ministerial Committee of Enquiry appointed for the purpose, and reports on work carried out will be made only to the Honourable the Minister for Agriculture and Forestry. This committee supersedes the original committee which was appointed by the Sugar Experiment Stations Board and the Central Cane Prices Board.

Two detailed and lengthy reports have already been submitted to the above Boards by the first committee. These have been made available on a limited basis as directed to the sugar industry. The circulation of any further reports will be under the direction of the Hon. the Minister.

It is therefore not permissible to discuss the project in this report, but it should be pointed out that the majority of the staff of the Mill Technology Division are occupied in this investigation. It follows therefore that the report of that Division which follows later in this Annual Report is less comprehensive than usual.

PUBLICATIONS BY BUREAU STAFF

Technical Communications.

Skinner, J. C.	Controlled Pollination of Sugar Cane.
Skinner, J. C.	Gravimorphism in Sugar Cane.
Sturgess, O. W. and Egan, B. T.	A Wilt Disease of Velvet Bean.
Sturgess, O. W.	Studies with Chlorotic Streak Disease of Sugar Cane.
Leverington, K.C.	Effect of Saline Conditions on Sugar Cane.

To the Proceedings of the Q.S.S.C.T.

Barrie, A. G.	Variations in the Yield of Farms with Equal Potential in the Mulgrave Area.
Bieske, G. C.	Aerial Fertilizing — Some Distribution Patterns.
Buzacott, J. H.	Progress in Development of New Varieties.
Egan, B. T.	A Preliminary Report on the Control of Yellow Spot Disease by Dusting with Copper Oxychloride.
Brain, L. R. (and Ellis, R. W.)	The Use of a Radioactive Tracer to Study Flow Patterns in a Subsider.
Nicklin, J. H. and Beale, R. F.	An Investigation of Impeller Operation in Vacuum Pans.
Pembroke, E. A.	The Mosaic Disease Campaign in the Farleigh-Habana Area of the Mackay District..
Rehbein, C. A. and Bates, G.	Review of Chemical Weed Control in North Queensland Canefields.
Skinner, J. C.	Selecting for Resistance to Lodging in Sugar Cane.
Wilson, G.	New Records of Cane Beetles in Queensland.

Four issues of the Canegrowers' Quarterly Bulletin and three News Letters were posted. A report on his visit to Taiwan was prepared by R. W. Mungomery. Six papers were presented by Bureau staff at the Twenty-second Conference of Cane Pest and Disease Control Boards.

Yours faithfully,

Assistant Director.

Appendix I

C.C.S. Formula

$$\text{C.c.s. in cane} = \text{Pol in cane} - \frac{\text{Soluble impurities in cane}}{2}$$

In practice, per cent. c.c.s. is calculated by the empirical formula—

$$\text{C.c.s.} = \frac{3P}{2}\left(1 - \frac{5 + F}{100}\right) - \frac{B}{2}\left(1 - \frac{3 + F}{100}\right)$$

where—

P = pol per cent. first expressed juice.
B = brix per cent. first expressed juice.
F = fibre per cent. cane.

Sugar Values, 1959 Season

The final prices for the 1959 season's sugar have been declared as follows:—

	No. 1 Pool			No. 2 Pool		Excess 5th Quota	Unassigned	Total
	Home Consumption	Surplus	Total	Excess 3rd Quota	Excess 4th Quota			
Tons	536,492	676,455	1,212,947	3,037	388	—	177	1,216,549
Per cent.	44.2305	55.7695	100	—	—	—	—	—
Price	£56 8 6	£40 7 9	£47 9 7	£30 10 0	10/-	..	10/-	£47 8 4

In addition the value for New South Wales production was:—

	Home Consumption	Surplus	Total
Tons	37,309	33,207	70,516
Per cent.	52.9080	47.0920	100
Price	£56 8 6	£40 7 9	£48 17 5

Table A

Summary of production and consumption figures and sugar values for ten years

Year	Total Sugar Production at 94 n.t.*	Total Sugar Exported at 94 n.t.	Average Australian Price	Average Export Price	Average Price No. 1 Pool Sugar	Average Price all Sugar	Total Value
			£ s. d.	£ s. d.	£ s. d.	£ s. d.	£
1950	879,686	395,748	24 11 0	32 16 6	28 4 1	28 5 4	24,866,084
1951	704,043	154,486	33 14 0	36 15 6	34 7 4	34 7 6	24,200,837
1952	934,226	471,008	44 3 0	41 2 0	42 14 2	42 12 3	39,809,505
1953	1,220,025	730,566	47 18 6	38 13 9	43 8 3	42 7 11	51,721,505
1954	1,300,842	784,449	47 1 0	37 8 0	42 9 11	41 4 7	53,635,071
1955	1,135,341	624,527	46 18 0	38 11 6	42 14 2	42 6 5	48,047,797
1956	1,171,518	673,751	53 11 6	41 6 5	47 1 9	46 10 6	54,506,608
1957	1,255,911	740,555	54 3 0	45 16 8	49 17 2	49 5 0	61,849,607
1958	1,353,228	832,181	54 15 0	39 8 2	47 4 5	45 6 3	61,321,200
1959	1,216,549	680,057	56 8 6	40 6 2	47 9 7	47 8 4	57,684,795

*Excluding Local Sales.

Table I

Sugar Cane Harvested, 1959 -Estimated, 1960

Domestic Tonnages	Actual Tonnages Accepted	Condemned	Mills	Estimated, 1960 (May estimate)
217,208	217,208	108	Mossman	250.000
329,736	329,736	5	Hambledon	350,000
350,894	350,894	11	Mulgrave	378,250
359,441	359,441	—	Babinda	370,000
285,491	285,491	156	Goondi	288,000
255,532	255,532	—	Mourilyan	264,000
356,601	356,601	—	South Johnstone	396,836
370,552	370,552	84	Tully	388.490
601,144	601,185	—	Victoria	690,000
335,193	335,193	13	Macknade	378,000
3,461,792	3,461,833	377		3,753,576
176,092	176,051	—	Invicta	195,000
307,500	307,500	17	Pioneer	338,560
325,247	325,247	20	Kalamia	364,320
397,976	397,976	42	Inkerman	418,480
1,206,815	1,206,774	79		1,316,360
316,946	316,946	15	Proserpine	350,000
295,648	295,623	—	Farleigh	330,000
289,522	289,501	49	Racecourse	400,000
288,235	288,313	51	Pleystowe	370,000
282,413	282,381	—	Marian	335,000
161,335	161,335	—	Cattle Creek	190,000
166.026	166,026	2	North Eton	238,000
283,567	283,567	—	Plane Creek	366.000
2,083,692	2,083,692	117		2,579,000
267,169	267,169	14	Fairymead	330,000
137,006	137.006	—	Qunaba	150,000
254,066	254,066	19	Millaquin	350,000
279,425	279,425	—	Bingera	360,000
108,001	108,001	—	Gin Gin	120,000
297,005	297,005	15	Isis	450,000
145,046	145,046	6	Maryborough	200,000
145,713	145,713	—	Moreton	206,000
42,001	42,001	—	Rocky Point	60,000
1,675,432	1,675,432	54		2,226,000
8,427,731	8,427,731	627		9,874,936

Table II

Sugar Production (94 Net Titre), 1954-1959

Districts	1954	1955	1956	1957	1958	1959
North of Townsville	502,276	413,853	406,172	516,345	540,476	485,660
South of Townsville	789,969	721,822	765,698	739,926	813,067	731,360
Totals*	1,301,245	1,135,675	1,171,870	1,256,271	1,353,543	1,217,020

*Local Sales included.

Table III
Classes of Cane Harvested, 1959

Districts	Plant Cane		Ratoons		Standover		Total Acres
	Acres	%	Acres	%	Acres	%	
Northern ..	45,465	36.4	79,449	63.6	78	—	124,992
Burdekin ..	20,784	53.5	14.089	36.3	3,979	10.2	38,852
Mackay	46,111	57.7	33,597	42.0	251	0.3	79,959
Southern ..	20,155	36,0	31,213	55.8	4,561	8.2	55,929
Whole State	132,515	44.2	158,348	52.8	8,869	3.0	299,732

Table IV
Total and Average Yields by Districts, 1959

Districts	Tons of Cane	Tons Cane per Acre	Tons 94 n.t. Sugar per Acre
Mossman-Ingham	3,461,792	27.70	3.89
Lower Burdekin	1,206,815	31.06	4.69
Proserpine	316,946	23.33	3.34
Mackay	1,766,746	26.62	4.07
Bundaberg-Gin Gin	1,045,667	31.14	4.42
Childers-Maryborough	442,051	26.44	3.56
Nambour-Beenleigh	187,714	33.34	4.57
Whole State	8,427,731	28.12	4.06

Table V
Acres Cultivated and Harvested, Yields of Cane and Sugar, Acre Yields and Quality of Cane, 1950-1959

Year	Acres* Cultivated	Acres Harvested for Milling	Total Yields		Yields per Acre		Tons Cane per ton Sugar
			Cane	Sugar†	Cane	Sugar	
1950	381,545	257,562	6,691,706	879,844	25.98	3.42	7.61
1951	388,348	273,371	5,005,172	704,342	18.31	2.58	7.11
1952	419,834	274,757	6,841,536	934,614	24.90	3.40	7.32
1953	466,484	332,703	8,751,063	1,220,383	26.30	3.67	7.17
1954	486,741	367,640	9,864,305	1,301,245	26.83	3.54	7.58
1955	482,145	365,252	8,616,163	1,135,675	23.59	3.11	7.59
1956	480,116	360,932	8,978,081	1,171,870	24.87	3.25	7.66
1957	485,355	364,985	8,945,617	1,256,271	24.51	3.44	7.12
1958	486,801	356,210	9,740,795	1,353,543	27.35	3.80	7.20
1959	461,885	299,732	8,427,731	1,217,020	28.12	4.06	6 92
Averages ..	453,925	325,314	8,186,217	1,117,481	25.16	3.44	7.33

*Supplied by Government Statistician. †Includes Local Sales.

Table VI
***Details of Molasses Disposals for Periods 1950-1959**

Usage	Tons of Molasses									
	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
Distilleries ..	99,940	79,063	99,410	154,152	153,212	151,349	159,733	128,487	159,290	141,219
Fertilizer	36,446	34,529	47,260	75,781	69,446	70,691	60,841	68,001	66,637	41,710
Stock Feed ..	36,621	37,151	37,099	36,263	38,046	35,127	36,699	30,385	39,937	35,469
Mill Fuel	15,556	6,327	5,882	1,211	7,140	10,095	9,315	1,774	736	1,361
Ferment	3,582	2,033	2,532	3,196	2,779	2,727	2,871	2,411	2,828	2,520
Other Purposes ..	231	9	151	217	352	1,179	595	762	531	373
Wasted	325	235	482	1,111	1,544	1,232	341	1,778	703	494
Totals ..	192,701	159,347	192,816	271,931	272,519	272,400	270,395	233,598	270,662	223,146

*Supplied by Government Statistician.

Table B

Table of Mill Peaks (Tons of 94 n.t. Sugar)

Mill	1929	1939	1949†	1950†	1952	1953	1954	1957	1958	1959	1960
Mossman	14,972	20,000	22,000	22,000	24,000	31,000	31,000	31,000	31,000	31,000	31,000
H'bledon	31,836	36,000	39,600	39,600	41,000	44,000	44,000	47,500	47,500	47,500	47,500
Mulgrave	31,643	36,000	40,100	40,100	40,500	47,500	47,500	47,500	47,500	47,500	47,500
Babinda	31,901	36,000	39,600	39,600	42,500	46,000	46,400	46,400	46,400	46,400	46,400
Goondi	27,034	29,500	32,400	32,400	34,500	38,000	38,000	38,000	38,000	38,000	38,000
Mourilyan	23,630	27,000	29,700	29,700	31,000	34,000	34,000	34,000	34,000	34,000	34,000
Sth J'stone	30,979	36,000	39,600	39,600	42,500	47,000	47,000	49,000	49,000	49,000	49,000
Tully	30,930	38,000	42,100	42,100	45,000	47,000	47,000	50,000	50,000	50,000	50,000
Victoria	32,221	37,500	43,600	49,100	52,000	78,000	82,000	84,000	84,000	**90,000	90,000
Macknade	30,952	34,000	39,900	46,500	48,500	52,000	52,000	52,000	52,000	52,000	52,000
Invicta	11,736	16,000	18,300	19,100	20,500	30,000	30,000	30,000	‖127,000	27,000	27,000
Pioneer	21,391	26,000	30,100	34,000	35,500	45,000	45,000	47,000	47,000	47,000	47,000
Kalamia	26,053	31,000	35,400	35,600	38,000	48,000	48,000	49,000	49,000	49,000	49,000
Inkerman	*24,207	31,000	36,800	42,000	45,000	55,000	55,000	57,500	57,500	58,700	58,700
Proserpine	16,650	23,000	26,300	33,000	35,000	43,000	43,000	45,000	45,000	45,000	45,000
Farleigh	16,993	23,000	27,600	32,400	33,500	42,000	42,000	44,000	44,000	44,000	44,000
R'course	18,066	24,000	29,000	35,200	36,500	36,500	42,000	42,000	44,000	44,000	44,000
Pleystowe	19,871	24,000	29,200	35,900	37,000	45,000	45,000	45,000	45,000	45,000	45,000
Marian	18,997	24,000	28,600	32,300	33,500	42,000	42,000	42,000	42,000	42,000	42,000
Cattle Ck.	8,791	12,000	13,400	14,100	14,500	20,000	20,000	21,000	21,000	23,400	23,500
Nth. Eton	9,319	12,000	14,500	15,900	17,500	26,000	26,000	26,000	26,000	26,000	26,000
Plane Ck.	18,233	24,000	28,600	30,800	32,500	42,000	42,000	44,000	44,000	44,000	44,000
Fairymead	15,882	21,000	25,700	28,600	29,500	37,000	37,500	37,500	37,500	37,500	37,500
Qunaba	8,940	10,000	11,200	12,700	13,500	15,500	§16,500	19,500	19,500	19,500	19,500
Millaquin	14,443	19,000	24,100	29,600	31,000	35,000	§39,000	37,000	37,000	37,000	37,000
Bingera	17,864	23,000	27,800	31,000	31,500	37,000	37,000	39,000	39,000	39,000	39,000
Gin Gin	6,000	6,500	8,000	8,400	9,000	12,500	13,000	14,500	14,500	14,500	15,500
Isis	28,011	27,000	30,000	30,200	31,500	33,000	35,000	37,500	37,500	39,500	39,500
M'borough	3,862	7,500	9,500	9,500	‡17,300	14,500	20,000	20,000	20,000	20,000	20,000
Mt. Bauple	6,231	6,500	7,200	7,200	..	..	..	..	..	..	..
Moreton	11,586	14,000	16,000	16,000	16,500	20,000	20,000	20,000	20,000	20,000	20,000
Eagleby	280	300	..	..	..	..	..	..	..	..	..
Rocky Pt.	2,014	2,200	2,700	2,700	2,780	3,500	4,000	5,000	5,500	5,500	6,000
	611,428	737,000	848,600	916,900	963,080	1,152,500	1,170,900	1,203,900	1,207,400	1,213,000	1,214,600

*Increased by 2,500 tons in 1938.

†Does not include 3 per cent. for Soldiers' Settlement.

‡Includes 4,800 tons for Mt. Bauple.

§As from 1955 season 2,000 tons peak was transfeerrd from Millaquin to Qunaba.

**Peak of 6,000 tons 94 n.t. sugar transferred from Invicta.

‖Balance of Invicta peak increased by 3,000 tons.

Recognition of soil characteristics is important. The effect of the occurrence of a sandy area (left) in an otherwise even block of well grown cane.

Division of Soils and Agronomy

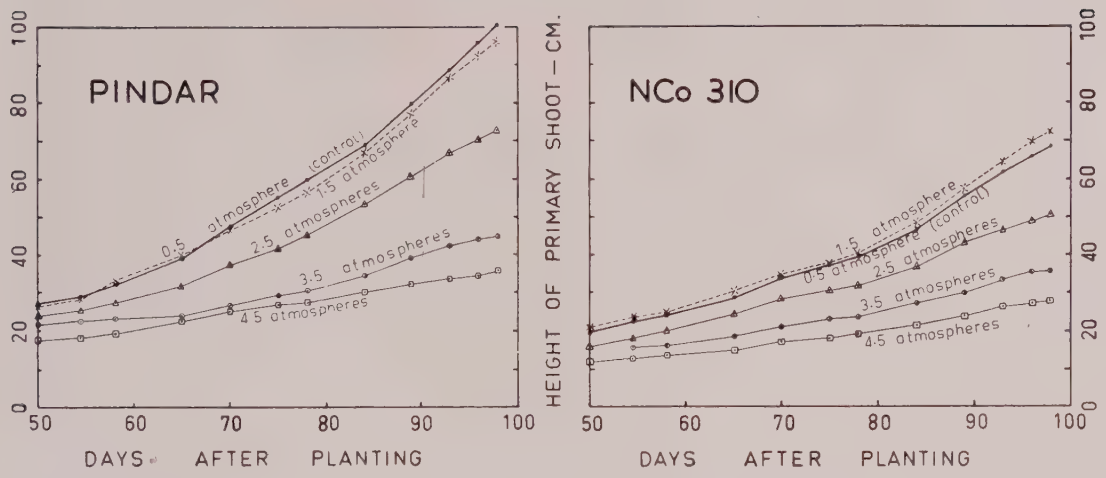
L. G. Vallance, Assistant Director

Ammonium Sulphate and Green Manure Crops

In the 1958 Annual Report were presented the results of a series of trials designed to show the effect of applications of ammonium sulphate as a top dressing on cane planted after a green manure crop had been turned into the soil. Although the results were somewhat conflicting they were of sufficient interest to prompt the extension of this work to cover a greater variety of soil types and district environments. Accordingly, in 1958, a total of 47 replicated observation trials and seven quantitative trials were set out in most of the cane growing districts of Queensland. In all of these trials a green manure crop of either velvet beans or cowpeas was turned into the soil two or three months prior to planting. In 40 of the observation trials a comparison was made between the two treatments, viz. no top dressing and 224 lb. of ammonium sulphate per acre. In the other seven observation trials which were conducted in the Burdekin district the comparisons were between top dressings of 224 and 448 lb. of ammonium sulphate per acre.

In only 11 of these 47 trials was there any indication of a response in yield to the higher nitrogen treatment and in only four of these was the response estimated to exceed five tons per acre. In four of the seven quantitative nitrogen trials, in which top dressings of up to 560 lb. of ammonium sulphate per acre were used, there was an indication of a response to added nitrogen in the yield of cane although only one proved to be statistically significant.

Throughout the season c.c.s. determinations were carried out on cane from the observation trials and from these results it appears that although there is a strong tendency for additional



The effect of different concentrations of salt on the rate of growth of primary shoots in the varieties Pindar and N.Co. 310.

nitrogen to depress the c.c.s. of cane during the first half of the crushing season, this effect is of no consequence if the cane is harvested later in the year.

Potash Nutrition Studies

The series of trials commenced in 1956 and designed to investigate the potassium requirements of the cane plant were continued and

Harvesting a potash trial. Poor growth due to lack of potash is most noticeable.

extended. In these experiments are being studied the effects of soil potash and applications of potassium chloride, at the rate of nil, 60, 120, 180, 240 and 300 lb. per acre, on yield and uptake of potassium by the plant. The second ratoon crop of one trial, the first ratoon crops of seven trials and the plant crop of one trial were harvested and four more 6 x 4 randomized trials were laid out. In one of the trials at Bundaberg, a split plot technique is being used to study the effect of nematodes on potash assimilation. Nemagon was applied at the rate of 2½ gallons per acre to half of each plot in this trial.

In all of the nine trials harvested during the year the control plots gave the lowest average yields of cane although in only six cases did the responses to potassium reach a statistically significant level. Analyses of leaf samples from all plots were carried out at several times during the year and while there was a marked increase in the potassium content of these leaves with increasing levels of potassium fertilization, at the moment it does not appear possible to deduce the optimum fertilizer application from the analysis of leaf material. It may be possible however to establish a critical level for leaf potash below which responses can always be expected.

Analysis of the soil and the sub-soil from all plots in each trial has been carried out before

The harvesting and weighing of yields from fertilizer and variety trials needs careful attention to detail.

Copper deficiency showing typical "droopy top" on a Mossman soil.

planting and after each harvest. There are indications that in some trials the higher potash treatments are bringing about an increase in the available potash content of the soil.

Copper Deficiency

It has been known for many years that soil applications of copper sulphate at the rate of 56 lb. per acre readily cure a symptom known as "Droopy Top", but it has sometimes been considered that this amount of copper is excessive and wasteful. On a black sandy loam at Mossman, treatments of copper sulphate at the rates of 14, 28, 42 and 56 lb. per acre, and molasses at the rate of five tons per acre, were applied to an area of young plant cane showing these characteristic symptoms of copper deficiency.

At harvest all treatments were statistically superior to the control, there being an increase in yield of approximately 10 tons of cane per acre. Although the treatment of 14 lb. of copper sulphate per acre produced slightly less cane than the heavier treatments the differences were not significant. It is not known whether the responses in the molasses plots were due to copper in that material or to some effect of the molasses on the nutrients in the soil.

Salinity Problems

Although the problem of saline soils and their effects on plant growth have for many years been the subject of research in arid parts of the world, until recently little had been done in the moist cane growing areas of Queensland as the salinity problem had never reached significant proportions. However, following the post-war expansion of the sugar industry which led to the cultivation of some marginal land, reduced

growth due to saline conditions has assumed a place of importance in a number of cane growing areas. An investigation has now shown that by comparing the specific electrical conductivity of the 1:5 soil-water suspension with observed field conditions of growth it is possible to deduce approximate critical levels of salinity to be used in advisory work for sugar cane.

The collection of profile samples from four saline sites in the Moore Park development near Bundaberg was continued throughout the year. These samples, which have been taken every two months since April, 1958, have shown marked seasonal fluctuations in salt content, but there does not appear to be any general improvement in salinity level of the areas sampled. There are indications from deep profile samples taken during the wet season that the total salt content of some profiles may be increased during this period, by the rise of a saline water table.

Nutrient investigations in the Brisbane glasshouse.

As many of the saline areas which occur in various districts have been found to contain appreciable quantities of magnesium sulphate as well as sodium chloride, it was felt desirable to know more about the effects of specific ions on the growth of cane and a series of experiments in sand cultures has been initiated. An experiment with sodium chloride was concluded during the year and one with magnesium sulphate is now nearing completion.

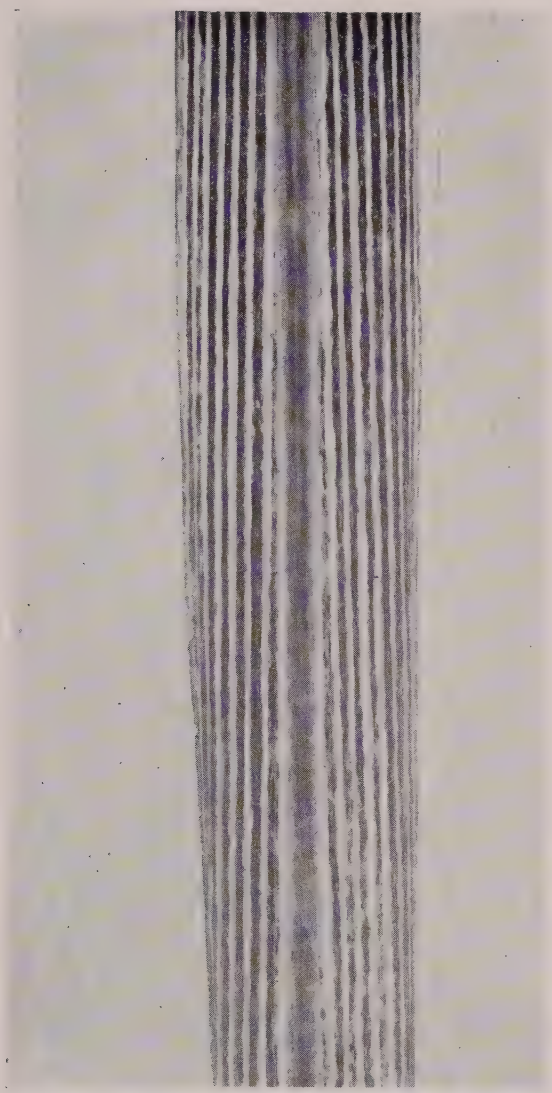
For this work one-eye seed pieces were planted in sand in four-gallon drums each of which was irrigated once every hour with one gallon of nutrient solution. Five levels of salinity were used : viz., a control of basal nutrient solution with a conductivity of 1.5 millimhos per cm, and four others made by the addition of an appropriate salt to the basal nutrient solution to raise their specific electrical conductivities to 3.9, 6.5, 9.1 and 11.6 millimhos per cm respectively. In the sodium chloride experiment the solutions developed osmotic pressures of 0.5, 1.5, 2.5, 3.5 and 4.5 atmospheres respectively.

Germination did not appear to be affected by salinity but within four weeks of planting depressed growth was obvious in the more highly saline treatments. The deleterious effects of sodium chloride became more apparent with age, severely retarding stem elongation, root development and tillering. The accompanying graphs illustrate the effects of sodium chloride on the rate of growth of the two varieties studied.

While the second experiment is not yet complete there are indications that irrespective of whether sodium chloride or magnesium sulphate is used to raise a basal nutrient solution to a particular conductivity level the effect on the growth of cane is similar.

Nutrient Deficiency Symptoms

During the year an experiment was initiated to determine the leaf symptoms associated with



The interpretation of leaf symptoms is important. These were induced in the glasshouse by witholding potash from the plant at a certain stage of growth.

various nutrient deficiencies. Plants of the variety N.Co.310 were established in complete nutrient solutions before introducing deficiency treatments. Symptoms of deficiencies in potassium, calcium and magnesium have been determined for comparison with field observations.

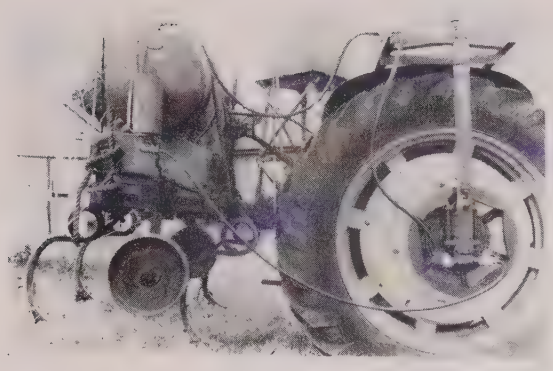
Analytical Work

Samples of soil and plant material from experimental plots again constituted a major part of the analytical work performed at the Mackay and Brisbane laboratories. At the latter centre 2555 samples were analysed including 887 soil samples and 216 leaf samples from the series of potash trials now being conducted. In the Brisbane laboratory where soil samples for advisory purposes are received from all districts except Mackay, 16 per cent. of the fertilizer recommendations made were for a high phosphate mixture, 30 per cent. for a high potash mixture and 54 per cent. for a mixture containing approximately equal amounts of phosphate and potash. Analysis indicated that 26 per cent. of the soils received for fertilizer recommendation contained adequate supplies of both potash and phosphate and on these soils a light application of a 2 cwt. per acre dressing of the latter mixture was recommended to maintain the levels of these two nutrients.

Some work has been carried out to determine the effect of various drying techniques and of temperature of leaching on the estimation of available potassium in soil. Results have shown that slightly elevated temperatures of either drying or leaching can bring about large increases in the quantities of potassium extracted by .02 N hydrochloric acid. For consistent results to be obtained it appears necessary to maintain some control over the conditions of drying and of extraction of the soil.

Soils, Nutrition and Weedicide Studies at Mackay

A total of 336 soil samples were analysed for the purpose of making fertilizer recommendations. The demand for this service was slightly less than for the previous year but it would appear that the initially high number of samples analysed during the first year of operation of this laboratory has fallen and become relatively stabilised at the present level.



An outfit set up to apply aqueous ammonia in a trial versus sulphate of ammonia on Mackay Station.

Analyses were also carried out on 447 soil samples taken from district potash trials. Seasonal variations were again noted in the monthly potash trial samples and preliminary investigations to ascertain the reasons for the variation indicated that the temperature at which the samples were air-dried and also the extraction temperature were affecting the analytical results.

Two more potash trials were planted while the two first ratoon trials were harvested. One of the latter was ploughed out while the other was ratooned again and, in this instance, potash was applied to only half of each plot in order to ascertain the residual effect of potash applied to the previous crop.

Six trials involving three levels of sulphate of ammonia (0, 2, 4 cwt. per acre) to be applied to plant cane following a bare fallow, inoculated legume, and non-inoculated legume were initiated. Two of the trials were abandoned due to failure of the legume crop. The remaining four trials were planted to cane for harvest in 1961. Legume plot yields were determined and samples were taken for nitrogen determinations.

A quantitative legume-sulphate of ammonia trial at Racecourse, was harvested. Although there were no significant differences from the application of sulphate of ammonia following a legume fallow there was the suggestion that the legume was not supplying adequate nitrogen for the plant crop.

A filter mud trial was initiated to evaluate the amount of nitrogen supplied by two levels of rotary filter mud, 40 and 80 tons per acre, which were applied in October, 1959, at the beginning of the fallow on Block C.4. A feature of the mud applications was the delaying effect on weed seed germination.

No effect on nut grass was obtained by spraying with aminotriazole at the rate of $2\frac{1}{2}$ lb. and 5 lb. active ingredient per acre. Cane sprayed at the two rates was severely checked in growth, the tops becoming completely chlorotic. Two months elapsed before the chlorosis disappeared. Satisfactory control of Gambia pea was achieved by spraying with 2, 4, 5-T at the rate of $\frac{1}{2}$ lb. acid equivalent per acre.

A number of farms were visited in regard to poor growth areas. Nutritional deficiencies, salt patches or adverse soil physical conditions were obvious in the majority of cases. Parasitic nematodes were present in unexplainable poor growth areas. Death of Malabar cowpea on Block A.4 was investigated and the absence of nodules and the presence of numerous nematode galls indicated the apparent cause. Soil temperature measurements were carried out on three different farms for the Pathology Division's information in regard to chlorotic streak investigations.

Legumes

The breeding work with cowpeas was continued at all four field stations and some agronomical aspects of green manure production were investigated. The family Havana x Black Eye 5 produced the ten best cowpea varieties selected at Meringa. Of the total 47 varieties selected, 12 were significantly higher in score for cover and in weight than the standard Reeves. In overall results from the four field stations the families C.P.I. 12153 x Malabar, C.P.I. 12153 x Black Eye 5 and Malabar x Black Eye 5 showed most promise and were characterized by good early cover, very good late growth and late seeding. In the

selection procedure particular attention is being paid to phytophthora resistance.

In a rate of seeding trial at Meringa better weed suppression was obtained with the heavier seeding rates, and in the same trial Black Eye 5 produced approximately four times the tonnage of green matter per acre than did Velvet beans. The latter legume was destroyed by phytophthora in another experiment whereas the cowpeas survived.

Susceptibility to attack by root knot nematodes seems likely to be a factor in eliminating varieties of cowpeas in selection trials. It appears that the variety Malabar is susceptible to nematodes in the lighter soil types.

A small planting of sunn hemp produced a yield of 15 tons per acre of green matter whilst the cowpeas Black Eye 5 and Havana yielded eight tons per acre.

On the Burdekin, velvet bean still constitutes the main green manure species because of the bulk of crops produced and its longevity in that area. In cowpea trials Malabar produced the best growth followed by Black Eye 5 and Santiago which gave similar results. Overall, Malabar is the recommended cowpea type for the area.

Attempts to overcome the shortage of legume seed supplies to cane growers resulted in successful persuasion of farmers on the Burdekin irrigation settlements to make trial sowings of cowpea varieties for seed production. Approximately one hundred acres of land were sown for this purpose and if the trials are a success and the economics of production favourable, seed supply difficulties should be overcome. Some six hundred tons of legume seed is required by the Queensland sugar industry for green manure crop production each year.

Control in Johnson grass by four applications of 5lb. dalapon per acre at weekly intervals.

Weed Control

Northern Districts — Infestations of the horned African cucumber, *Cucumis metuliferus,* appeared in the Mulgrave area and it was found that one half pint of 80 per cent. 2, 4, 5-T butyl ester in 80 gallons of water per acre gave satisfactory control. A mixture of 18 per cent. 2, 4-D and 16 per cent. 2, 4, 5-T as butyl ester, at six and two-thirds pints per acre was slower but just as effective whilst amitrol at twelve and a half and eighteen and three-quarter pounds per acre took approximately five weeks to destroy the vines. Commercial application by aircraft using the butyl ester of 2, 4, 5-T and mixtures of it with 2, 4-D was entirely satisfactory.

Several weedicides were tried for the control of Johnson grass, *Sorghum halepense,* which is infesting cane fields in the Sawmill Pocket area. Dalapon at 40 lb. per acre produced a kill in seven weeks, atrazine was unsatisfactory at 15 and 20 lb. per acre. "Weedazol Total" at 30 lb. per acre produced the same effects as dalapon but took 12 weeks to produce this result. Both dalapon and "Weedazol Total" affected the growth of the cane; the former severely and the latter slightly.

At Innisfail co-operation with other organisations on the attempted eradication of giant sensitive plant, *Mimosa invisa,* was continued.

Aerial spraying for vine control,*Ipomoea spp,* covered 4,500 acres of canelands in the Ingham district using 2, 4-D as the weedicide. Pre-emergence trials with CMU at 4 lb. per

The necessity for adequate weed control is indicated by this infestation of a block of cane by wild cucumber.

acre were disappointing. An approximate 50 per cent. weed control in the Abergowrie area was insufficient to eliminate the need for early cultivation while at Ingham positive control of grass was offset by failure to prevent growth of some broad leafed weeds particularly *Ageratum conyzoides.*

Experiments to control wild passion vine, *Passiflora foetida,* were continued and spraying with CMU at one ounce per gallon gave a satisfactory kill of young vines in cane. Similar sprays failed with mature vines.

Two infestations of cane killing weed.*Striga spp.,* were responsible for stunted growth in small patches at Yuruga and Bambaroo. However, this parasite can be satisfactorily controlled with 2, 4-D.

Lower Burdekin—The work on weedicides was continued with the object of developing a combination which would give effective control of grass and weeds in irrigation channels. It was found that 10 lb. of dalapon with 4 lb. of 2, 4-D gave the most effective and durable result if applied when growth was lush. PCP at 3.5 gallons per acre plus TCA at 35 lb. per acre were also effective, the control was not so long lasting but was quicker in action. Where nut grass, *Cyperus rotundus,* is present the dalapon-2, 4-D combination is preferable.

Both monuron and diuron were tried for control of weeds in irrigation channels and proved effective. Satisfactory control of weeds was obtained throughout the wet season by 40 lb. of either monuron or diuron. However, if these weedicides come into commercial usage it will be necessary to alter the shape of the drains to give more slope to the sides. Soil sterilization allows the steep sided drains to fall in. It was

also shown that repeated spraying of para grass with 10 lb. per acre of dalapon achieved eradication. After two sprayings the grass can be burned and any regrowth controlled by spot spraying.

The most effective way of eradicating Johnson grass was found to be the application of dalapon at 5 lb. per acre at weekly intervals. After four sprayings the top growth is completely killed but about 10 per cent. of the rhizomes are still alive. Spot spraying the new growth arising from these rhizomes should eliminate this weed. The most effective time for spraying is just prior to seeding when growth is most luxuriant. A trial combining dalapon and TCA also gave promise.

Spraying mature Johnson grass in ratoon cane with dalapon and TCA extensively damaged the cane without controlling the grass.

Southern Districts—Skirmish pre-emergence trials with monuron and diuron were set out at South Kolan in October and November. At 6 lb. per acre the two materials proved equally as effective as 2, 4-D at 4 lb. per acre in weed suppression. A satisfactory kill of prickly cucumber, *Cucumis sativus,* star of bethlehem, *Ipomoea quamoclit,* and bell vine, *I. plebeia,* was obtained on a district plantation by aerial application of a 2, 4, 5-T plus 2, 4-D formulation.

Excellent results in control of gambia pea were obtained by using a 20 per cent. 2, 4-D, 20 per cent. 2, 4, 5-T mixture. TCA continued to be the usual control of weeds on tramlines. An attempt to control gambia pea in a standing crop by aerial spraying was unsuccessful due to poor penetration through the cane foliage. This weed is, however, easily controlled by ground application of the weedicide.

Blue heliotrope, *Heliotropium amplexicaule,* continued as a weed pest in the Isis district. So far no satisfactory control for this plant has been developed. With all the formulations tried a complete kill of the root system to prevent regrowth has not been achieved. Trial work with this weed is still proceeding.

Shading Trials

Three shading trials aimed at elucidating the relative effect of reduced sunlight on two varieties of cane were completed at Meringa. The variety Pindar consistently produces a low sugar content as compared with Q.57 in the cloud affected areas at Babinda. The two varieties were grown in the field under 25 per cent. shade for comparison purposes. The shading produced a significant reduction in both sugar and weight with Pindar. The sugar from the shaded cane was only 83 per cent. of the unshaded. The differences for Q.57 were not significant. The trial indicated a varietal interaction with shading and provided a possible explanation of the good performance of Q.57 in the Babinda area.

Leaf Desiccation

With the potential increase of mechanical harvesting with machines which are not as selective as hand cutting in rejecting cane tops at harvest, chemical application to achieve reduction of tops in the harvest burn has become of considerable interest. The leaf desiccant "diquat" was applied to two varieties, Q.57 and Pindar, in November. Applications were made with a ground rig at 2.5 rising to 10 lb. per acre rates in aqueous solution. There was little difference between the rates in desiccation of the leaves. Three days after spraying the leaves were brown but not dry, two days later they were drier but still not brittle. Some tops were burnt and practically all but the midribs were consumed. Seven days after spraying the leaves were brittle.

The Q.57 plot was burnt 11 days after spraying and the Pindar plot 16 days from spraying.

The amount of extraneous matter and the sugar content was estimated from samples of both sprayed and untreated cane. The extraneous matter was reduced from approximately 10 per cent. in the untreated cane to approximately 5 per cent. in the treated cane in the case of both varieties. There was a considerable loss in sugar in the treated cane amounting to 1.5

units of c.c.s. in the case of Q.57, 11 days after treatment, and 0.7 units in the case of Pindar, 16 days after treatment.

Further detailed investigations of this material is planned at all field stations during the coming harvest season when sufficient supplies of chemicals will be available. Aerial application of desiccants will also be investigated.

It was of interest to note that "diquat" was not translocated in the cane foliage and that therefore a fairly complete coverage by the spray is necessary.

Chlorotic Streak Disease from the Agronomy Viewpoint

A trial was set out in drums in North Queensland to determine the effect of a number of treatments on symptom expression of diseased cane and on transmission of the disease to healthy cane. There was no great difference in the expression of symptoms between the two locations used (Meringa and Aloomba). In another set of drums it was shown that of four different soils used the Mt. Sophia soil was best for early expression and Meringa the worst. For late expression Fishery Falls soil was best. The Aloomba soil was intermediate in all cases. It was also found that heat treated soil provided a better medium for symptom expression than did normal soil. There was a marked interaction between time of year (late or early) and heat treatment, indicating that early and late expression of symptoms are two separate aspects and heat treatment is a factor which effects expression in opposite ways. The mixing of cane tops in the soil had no effect on symptom expression. Late expression of symptoms was markedly improved by water-logging but early expression was unaffected. Increase of symptom expression improved from early to late in all treatments except the heat treated one. The greatest increase took place in the water-logged and not heat treated soil.

The best expression of symptoms occurred in May and June. There was a marked drop in early February followed by a recovery.

Several trials comparing diseased and healthy material in the Mackay district were harvested. In all cases the healthy plots outyielded the diseased ones.

Germination Trials

The results of a series of trials indicated that the factor responsible for increased germination late in the season, following hot water treatment for three hours, was that the cane cut at that period was more resistant to heat damage as compared with the sensitivity of plants cut earlier in the season.

Nematode Investigations

Two sites on poor growth areas with high nematode populations in the Babinda district were fumigated. One site was set out as a replicated strip trial using nemagon at the rate of 2 and 2.5 gallons per acre with row treatments compared to broadcast treatments at the same rates per acre. The variety used was Pindar. At the end of June, 1960, the broadcast treatment at 2.5 gallons per acre appeared to be ahead of all other treatments and the controls were on the average seven tons per acre behind the 2.5 gallons per acre nemagon treatment.

In the other trial a 6 x 6 layout was used and the treatments were :—2.5 and 1.25 gallons per

Junior Farmers are taught the essentials of soil management and fertilizer practices.

acre nemagon as broadcast and row treatments, and EDB at 20 and 8 gallons per acre as both broadcast and row treatments, and DD similarly at the same rate. Both nemagon rates have held a steady lead over the other treatments and at the end of June the 2.5 gallons per acre broadcast treatment appears best with a lead of about 12 tons per acre of cane over the controls. EDB at 20 gallons per acre is almost equal to 1.25 gallons row treatment with nemagon, whilst the remainder are slightly better than the controls. It was of interest to note that all the DD treated plots became heavily infested with weed growth. The average crop in the trial area was approximately 40 tons per acre. The ratoons of the nemagon trial of the previous season showed a favourable response to the treatment applied to the previous crop.

High parasitic nematode populations occurred in association with poor germination and growth in the Ingham Line district, and four exploratory fumigation trials were set out. The occurrence of drought conditions, however, vitiated the results of these trials. On the Lower Burdekin good responses on light alluvial soils were obtained by fumigating with both DD and EDB. No response was obtained by using nemagon in another trial in this area.

At Mackay a comprehensive trial was set out on an area with a high nematode population where ratoon crops had always been poor or had failed. Materials used were nemagon and DD, both at a series of dosage rates. The trial will be harvested later in the year. Recent nematode population counts on the different plots indicate that nemagon at all rates from 5 to 1.5 gallons per acre have effectively kept the nematode population down whilst in the DD plots the population, although originally reduced to a figure comparable with nemagon has now, six months from treatment, in all cases exceeded the pre-treatment level and that of the controls by almost 100 per cent.

The trial harvested last season at Pinnacle when good results were obtained from DD and EDB treatments continued to show plot differences in favour of the treatments in the ratoons although the nematode population has now regained its former level. This is probably due to the extra vigour of the stools of the treated plots due to the treatment.

Two other skirmish trials set out in the district using nemagon at 2.5 gallons per acre showed a good response.

Trials to test resistance of different cane varieties to nematodes were set out at Bundaberg and Mackay. In these trials one half of each plot was fumigated with nemagon at 2.5 gallons per acre. There is a strong indication resulting from field observations that some varieties are relatively more resistant than others. Amongst the probably resistant varieties are Pindar, Q.47 and L.622.

At Bundaberg two skirmish trials using DD and EDB show improved growth over control plots and a further strip trial on Fairymead plantation using nemagon at 2.5 gallons per acre has shown a favourable response. Overall, however, the amount of damage due to nematodes in the Bundaberg district is obscure because of interaction of other factors such as soldier fly infestation.

The nematode fumigation trials set out in connection with chlorotic streak investigations in this area showed negative results in regard to this disease.

The species of parasitic nematodes found in association with poorly grown cane during the year consisted mainly of the following : *Pratylenchus brachyurus, P. zeae, Tylenchorhynchus martini, Helicotylenchus nannus, H. erythrinae, Xiphinema pratensis, Longidorus sp., Trichodorus minor, T. christei, Criconemoides rusticum, Criconemoides spp., Trophurus s.p., Meloidogyne javanica, M. arenaria* and *M. incognita.*

Harvesting a variety trial at Meringa Station

Northern Sugar Experiment Station

G. Bates, Officer-in-Charge

Weather and Crop Notes

Rainfall for the year ending June, 1960, was under average. Only 60.75 inches were recorded, the average being 74.68. Soil conditions in July at the commencement of the 1959-60 growing season were rather wet. The wet season had continued into the winter which caused a reduction of the acreage of early (autumn) planted cane, so that the spring planting was heavy. The rainfall from July to September was somewhat abnormal, being 5.28 inches compared with the average of 3.14 inches. In August 3.83 inches fell, disrupting harvesting and planting operations. There was then a dry spell in October, which allowed farmers to ratoon, apply fertilizer and clean up the plant cane. The young cane had ideal growing conditions and made rapid growth. Nearly seven inches of rain fell in December, which ensured adequate moisture until the wet season commenced.

Planting Conditions for the 1960-61 Crop

The wet season tapered off quickly. After the above-average rainfall for December and January, the following three months yielded much below normal. February rainfall was the lowest since 1952 while April rainfall was a record low for the past 36 years. This "dry" wet season enabled growers to get a record acreage ready for early (autumn) planting. This is in contrast to last year when the early planting was the smallest recorded. Early germinations were good, but some of the later ones suffered from pineapple disease, notably where mercurial dips had not been used. There was no serious flooding, nor were there strong winds during the summer and, at the commencement of

crushing in mid-June, cane crops generally were in very good condition, although arrowing was early and abundant.

The early cessation of the wet season is reflected in the high c.c.s. figure obtained at the commencement of the 1960 crushing season.

Pests and Diseases

Moderate to severe greyback grub damage developed in many localities where BHC had not been used, but the total area involved was not serious. Frenchi grub damage was not important, but wilsoni and Mossman grubs caused a few hundred tons loss in the Mossman area.

Rat damage was again at a minimum in the 1959 crop, but there was evidence of a build up, and cane for 1960 harvest was being damaged somewhat earlier than usual.

Some trouble was experienced in the Mulgrave area from the African horned cucumber, *Cucumis metuliferus,* in crops approaching maturity. The position was getting serious on several farms. Experiments showed that half a pint of 80 per cent. 2,4,5-T per acre gave effective control.

The known susceptibility of Q.66 to leaf scald is making itself evident in the increasing number of blocks with this disease in the Mulgrave and Babinda area. Top rot was widespread in Q.67 plantings in Babinda although losses were not severe. Yellow spot failed to develop to any extent following the below-average wet season.

RAINFALL RECORDS, 1924-1960.

Year	Rainfall (inches)	Year	Rainfall (inches)
1924-25 ..	82.86	1942-43 ..	64.60
1925-26 ..	49.56	1943-44 ..	52.92
1926-27 ..	80.34	1944-45 ..	120.34
1927-28 ..	56.46	1945-46 ..	63.95
1928-29 ..	92.83	1946-47 ..	35.24
1929-30 ..	69.99	1947-48 ..	69.12
1930-31 ..	75.62	1948-49 ..	85.77
1931-32 ..	61.87	1949-50 ..	82.50
1932-33 ..	90.02	1950-51 ..	67.68
1933-34 ..	119.49	1951-52 ..	52.86
1934-35 ..	58.22	1952-53 ..	83.98
1935-36 ..	87.64	1953-54 ..	68.15
1936-37 ..	49.54	1954-55 ..	99.81
1937-38 ..	53.98	1955-56 ..	71.91
1938-39 ..	126.39	1956-57 ..	76.27
1939-40 ..	82.10	1957-58 ..	75.01
1940-41 ..	80.59	1958-59 ..	82.83
1941-42 ..	45.15	1959-60 ..	60.75

Average rainfall for 36 years, 74.35 inches.

Abstract of Meteorological Observations made at Northern Sugar Experiment Station, Gordonvale, from 1st July, 1959 to 30th June, 1960.

Month	Rainfall in Inches	Average Rainfall	No. of Wet Days	Shade Temperature						Mean Diurnal Range	Mean Temp. 9 a.m to 2 p.m.	Mean Per Cent Relative Humidity 9 a.m.	Average Daily Hour Sunshine
				Maximum			Minimum						
				High	Low	Mean	High	Low	Mean				
1959													
July	0.45	1.03	8	85	72	78.48	68	39	55.89	22.59	68.55	83.39	6.0
August	3.83	1.03	10	84	76	80.35	69	41	55.16	25.19	68.8	80.67	6.95
September	1.00	1.13	11	93	78	82.3	67	52	59.8	22.5	72.4	75.5	7.68
October	0.02	1.43	2	93	80	88.59	69	52	62.08	26.51	79.13	60.93	9.34
November	2.15	3.07	13	97.5	84	90.98	74.5	63	68.88	22.10	82.03	68.27	8.02
December	6.95	5.24	15	99	86	93.35	78.5	70	74.60	18.75	84.13	76.71	6.56
1960													
January	23.15	16.01	24	93.5	80	88.39	75	66	71.11	17.28	80.66	83.0	6.29
February	8.96	18.90	21	95.5	85	89.83	78	69	72.6	17.23	80.22	85.86	6.10
March	10.06	15.80	24	93	81.5	86.55	75	64	69.5	17.05	78.23	84.06	5.0
April	0.46	5.96	15	90.5	81	86.84	70	62	66.07	20.77	77.71	79.89	7.04
May	2.93	2.66	8	89	72	81.36	70	48	59.02	22.34	71.55	77.31	5.76
June	0.79	2.09	9	84.5	72	79.46	67	46	59.96	19.50	70.22	79.96	5.87
Totals	60.75	74.35	160										

Maturity testing of canes requires many c.c.s. determinations.

Weed control on Meringa Station, unsprayed on left, sprayed area on right.

EXPERIMENT STATION OPERATIONS

Seedling Raising and Selection

In conformity with usual practice fuzz was planted in the glasshouse in July, and subsequently 32,700 seedlings were planted in the field in October. These consisted of 5,700 spaced seedlings and some 27,000 in bunches.

Selections during June-July, 1959, resulted in 5,765 seedlings being selected for further plantings. These consisted of 467 in 30-sett plots, 2,311 in 4-sett plots and 2,964 in 2-sett plots, and 23 were planted in a lattice square yield observation trial.

New Varieties Imported

Seventy-eight varieties were introduced to this station during the year for use in breeding work and for trial as commercial canes.

Legume Trials

Propagation was continued of 79 cowpea varieties which were selected from types bred on this station.

Propagation also continued with the recently bred varieties. Thirteen F2 families and eleven F5 families were planted out. Seed was harvested from these plots for further trials. A rate of seeding trial, using three different rates — 10, 20 and 40 lb. per acre — was set out. A good crop resulted in all instances and indications are that lower seeding rate gave slightly higher amounts of green matter, but the 10 lb. rate allowed growth of weeds and grass.

Hot Water Treatment

All new varieties imported into this station and all new varieties brought forward from the yield observation plantings are hot water treated for three hours at 50°C. prior to being planted out on other station blocks or sent out for farm trials. In 1959, 136 varieties including the 1957 New Guinea collection were treated in this manner.

Experiments Harvested During the Year

A first ratoon yield observation trial consisting of nineteen 55N series, Q.70 and Q.58, with Pindar as a standard, was harvested. In the final grading, taking into account both plant and ratoon crops, no variety approached the standard. It is worthy of note that the 55N series in this trial were selected from the cyclone damaged original seedlings in 1956.

In the plant yield observation trial where twenty-one 54N series seedlings, together with M.421 and Q.68 were compared with Pindar, four varieties gave a better grading than the standard. They were 54N6444, 54N7034, 54N7100 and 54N7105. The trial will be harvested again in the ratoon crop.

Field Day

Field Day was held on 21st April when 400 persons visited the station. This is a decrease on last year due to the fact that the weather conditions were ideal for land preparation and

Parent canes in full flower on Meringa.

planting at that time, so many growers seized the opportunity to carry out this important work.

Breeding Cane Collection

The variety garden was maintained and there are now 542 varieties on the station exclusive of original seedlings and seedlings under test. Varieties are continually being discarded whilst new ones are obtained.

Collecting drainage water from low-lying portions of Meringa Station for chlorotic streak investigations.

Miscellaneous

The thirteen acres of forest land purchased last year have all been cleared and brought under the plough. Most of it has been planted, and the balance will be planted this spring.

Laboratory Work

The following is a summary of cane samples handled during the year :

Station and trial samples	1,567
Farmers' samples	33
	1,600

Summary of Crops Grown on the Station

	Tons
Parent canes and trials	633.15
Original seedlings	117.49
	750.64
Plant cane harvested for mill	399.39
Ratoon cane harvested for mill	351.25
Used for plants, samples, cross-pollination, farm trials, etc.	30.00
	780.64
Area of plant cane harvested	12.0 acres
Area of ratoon cane harvested	12.0 acres
Average tons per acre	32.5 tons
Average c.c.s.	13.23

View of the Lower Burdekin Sugar Experiment Station.

Lower Burdekin Sugar Experiment Station

G. A. Christie, Officer in Charge

Meteorological Conditions

The year 1959-60 proved an excellent one for cane production in the irrigated lands of the Lower Burdekin and Giru districts, with rainfall a little above average, relatively high hours of sunlight and an absence of cyclonic winds. There was little or no interruption to harvesting during the 1959 crushing season, for the dry weather from July to November permitted pre-harvest burning and transport of the cane from the field.

July, 1959, commenced with mild winter conditions, but a cold change near the end of that month brought light frost damage to some low areas. Only 121 points of rain fell for the five months, July to November, but increasing temperatures provided good conditions for crop growth. With the low rainfall, soil moisture was maintained by irrigation. The hot weather of December was broken by evening storms. These continued throughout January when lighter falls were recorded and, following higher registrations in February, the wet season rains ceased about the middle of March. The dry period from mid-March, through April to the early part of May permitted the preparation of land and autumn plantings for the 1961 harvest. Unseasonal storms in the latter half of May were followed by cold weather, and in June many parts of the area were affected by frosts.

The area experienced no cyclonic winds during the year and practically all cane was erect at the commencement of the 1960 harvest. One outstanding feature of the wet season period was the numerous sunny days during the months of higher temperatures. Much of the rain fell at night, and days were generally clear; this is expected to result in a high average sugar content in the cane for 1960 harvest.

Crop Notes

The crop harvested in 1959 showed an appreciable drop in average tonnage of cane per acre over the whole district. This is explained partly by some damage having been sustained from the severe cyclone of February, 1959, and partly by the fact that potential crops on most farms were considerably in excess of those required to produce the sugar quota allotted to those farms. This in turn indicated that too great an acreage was under cane, and therefore production per acre was restricted intentionally by reduced irrigation as the crop approached maturity.

Pathological Notes

In February, 1960, excellent internal stalk symptoms of ratoon stunting disease were located in a number of fields of the variety Q.67 in the Lower Burdekin area. Further examination showed its presence in almost all commercial varieties on many farms and it is evident that control of the disease is not being achieved in some areas by present farm practices. Future measures should include the use of larger quantities of disease-free planting material and more efficient farm hygiene in order to reduce contamination of clean cane.

Field observations on the disease suggest that the variety Q.67 is seriously affected by the disease, poorer germination and growth and weaker ratoons generally developing from infected plants. Quite extensive infection in the variety Trojan, which constitutes nearly 80 per cent. of the district's crop, was also detected and this, no doubt, is another factor connected with reduced crop production in the district. An expansion of the hot water treatment of planting

Characteristic recovery from cyclone damage in Pindar. The top is completely removed and subsequently replaced by vigorous shoots from top eyes.

Destroying a standover crop in the Burdekin district with a blade in front of the tractor and a roller behind The residue is subsequently burnt and ploughed under.

material by Cane Pest and Disease Control Boards was recommended and an improvement in the ratoon stunting disease position is expected from the increased efforts directed towards its control.

Chlorotic streak disease which had previously been recorded on a number of farms in the Giru area, was found on only one of the previously infected farms during the year. This does not mean that it has been eliminated from other centres, but that symptoms were not visible at the times of inspection.

In March and June, 1960, this disease was also located in the Lower Burdekin district, three farms on the southern side of the river and one on the northern side showing definite symptoms. In each case the diseased cane was located in low areas subject to flooding. Inspections to determine the extent of infection were to be undertaken at a suitable time.

Bacterial mottle was found in several fields which were subjected to river flooding, but losses were practically negligible.

Specimens of basal root rot, which had previously been located in Q.67, were submitted for pathological investigation, and field inspections carried out during the year showed that it was present in a large number of fields in almost all commercial varieties. The minor crop losses involved made it of little economic importance at this stage.

Entomological Notes

Extensive flights of greyback beetles occurred in several parts of the district during the summer months of December, 1959 and January,

1960, but since most of the cane had been protected by applications of BHC, losses were comparatively light, damage being restricted to unprotected fields. The widespread grub infestation provided an excellent opportunity for comparing the efficiency of BHC dust and lindane, the latter having been sprayed as a water suspension. Over 1,000 acres treated with lindane showed no apparent damage, and it must be concluded that this material is providing a satisfactory protection against greyback grubs.

Small infestations of the Giant Termite *Mastotermes darwiniensis* occurred in isolated localities, but crop losses amounted to only a few tons of cane for the area.

Other Pests

Counts of soil nematodes showed rather high figures in a number of samples submitted for examination. Heavier crops followed the use of DD and EDB, but nemagon applications showed no improvement in yield.

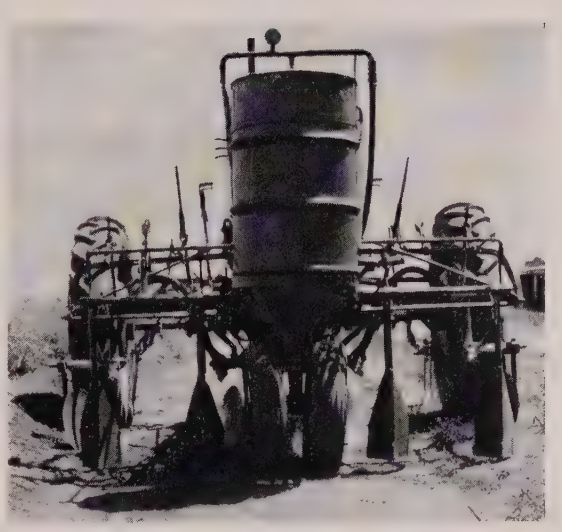
In areas adjacent to grazing land, wallabies caused damage to small plant and ratoon cane by nibbling the young shoots as they appeared through the ground. Such damage occurs annually during the dry spring and summer months when succulent feed is not available in natural grassland. Experiments with deterrents showed that one hundredweight of dried blood per acre sprinkled over the cane drill discouraged any feeding by wallabies, and under dry conditions it remained effective for four to six weeks. Two such applications, which also provide an added source of nitrogen and phosphoric acid for the crop, are sufficient to protect the cane until it reaches a stage when it is unattractive to wallabies.

Furrow irrigation is the normal practice in the Burdekin district. Young ratoons being watered.

Coots caused minor losses throughout the district, their attack on cane being concentrated on fields adjacent to lagoons. Shooting was found to be the most satisfactory means of dealing with these pests. It was thought that standover crops would provide a harbourage for rats and that their numbers and damage would increase. Observations, however, indicated that losses of cane from this cause were very small.

Legumes

With overproduction of cane, the area of fallow land increased, and many district growers attempted to augment soil productivity by legume cover cropping. Velvet beans, were quite extensively planted, but this legume is not ideally suited to the relatively short period of the wet season, for its slow early growth permits the establishment of weeds and grasses, while land preparation for autumn planting frequently necessitates the ploughing under of immature crops. The more rapidly growing cowpea varieties, Poona and Reeves, are more suited to local needs, but their susceptibility to stem rots has limited their planting. Experimental plantings of the cowpea varieties Malabar, Blackeye and Santiago produced excellent crops, all being far more resistant to stem rots than the standard cowpea varieties. Of the three, Malabar produced the best crop and showed promise as a suitable green manure crop for Burdekin conditions.



A two-row lindane sprayer mounted on front of tractor. This method of grub control is becoming increasingly popular in the Burdekin area.

Abstract of Meteorological Observations made at the Lower Burdekin Sugar Experiment Station from 1st July, 1959, to 30th June, 1960.

Month	Rainfall (inches)	No. of wet days	Shade Temperatures						Mean Diurnal Range	Mean Temp. 9 a.m.	Mean per cent. Rel. Humidity 9 a.m.
			Maximum			Minimum					
			High	Low	Mean	High	Low	Mean			
1959											
July	0.07	1	84	74	77.96	58	38	49.42	28.54	65.75	63.67
August	—	—	85	75	78.99	64	42	50.65	28.34	68.39	64.74
September	—	—	95	78	82.92	65	47	55.85	27.07	75.12	61.27
October	0.06	1	93	81	85.87	69	52	58.08	27.79	80.13	57.00
November	1.08	4	94	85	88.55	74	62	66.48	22.07	82.67	62.29
December	9.81	10	96	85	91.19	77	68	72.36	18.83	85.23	70.32
1960											
January	3.08	10	92	86	88.60	74	66	69.33	19.27	83.13	69.60
February	19.32	15	91	81	87.64	75	64	70.09	17.55	81.64	75.14
March	9.95	6	91	83	86.26	71	59	66.00	20.26	79.13	76.00
April	0.03	2	89	83	85.50	67	54	61.00	24.50	78.53	72.95
May	3.60	5	87	72	79.80	70	43	55.00	24.80	69.48	70.43
June	0.44	2	81	73	77.16	64	39	51.66	25.50	66.30	72.85
Totals	47.44	56									

A portion of the visitors at Field Day, Lower Burdekin Sugar Experiment Station. An address by Mr. B. Foley, O.B.E.

In order to encourage the production of seed, arrangements were made with both Delta and Burdekin Valley farmers to plant areas of Malabar and Blackeye, and the result of this first crop for seed was encouraging. While the gross return may not be high, costs of production are low and the crop residues left after harvesting should result in improved growth of following crops.

Weed Control

Favourable results in the control of weeds and grasses in irrigation feeder channels were obtained by a foliage spray on the young plants of 10 lb. of dalapon and 4 lb. of 2,4-D per acre. Even under favourable conditions, the death of plants is slow, but there appears to be a lasting pre-emergence effect which keeps the channel free from vegetation for some considerable time.

Further experiments on the control of Johnson grass were continued and it is highly probable that effective results can be expected from several light applications of dalapon. More effective results were obtained when well developed but non-seeded plants were sprayed at a period of maximum growth.

During the year, nut grass eradication on the Experiment Station proceeded on an increased scale, patches totalling 2 1/3 acres being treated with methyl bromide under plastic sheets. In addition other areas such as the mill tramline passing through the property, which could not be effectively treated with the fumigant, were sterilized by applications of 2,4-D powder at the rate of 2 lb. per 100 square feet. Both treatments were highly effective in eradicating the weed.

EXPERIMENT STATION ACTIVITIES

Raising and Testing of Cane Seedlings

The raising and testing of seedlings, and the introduction of new varieties from other districts and other countries continued to occupy a highly important place in the work of this Experiment Station.

A total of 11,095 original seedlings were available for selection in June, 1960, 6,120 of these being from seed plantings. The remaining 4,975 were from sett plantings obtained from the previous year's bunch-planted seedlings. These yielded 112 seedlings of high relative grading which were planted in 40-sett plots, and 508 of lower grade which were planted in 4-sett plots.

Twenty-one seedlings were selected from the previous year's planting of 40-sett plots for inclusion in an advanced replicated trial.

In the harvest results of the plant crop of the 56A-series seedlings, seven new seedlings under trial out-yielded the standard Trojan, while 17 produced a greater yield of sugar per acre than Pindar, which was extensively damaged by cyclonic winds. Yields of the leading canes were :—

Useful results are being obtained with chemical weed control investigations in irrigation channels.

Variety	Tons Cane/Acre	C.c.s. at Harvest	Tons Sugar/ Acre
56A528	43.07	19.46	8.35
56A476	45.00	18.37	8.27
56A513	46.79	17.31	8.10
56A521	42.57	18.85	8.03
56A509	46.09	17.10	7.87
56A471	39.27	19.72	7.74
56A464	42.55	18.10	7.69
Trojan	42.16	18.22	7.67

Another advanced replicated trial harvested in 1959 included three 54A-series seedlings, Vidar and the two standards Trojan and Pindar. Yields were as follows for the plant crop :—

Variety	Tons Cane/Acre	C.c.s. at Harvest	Tons Sugar/ Acre
54A547	43.10	18.65	8.03
Trojan	42.52	18.24	7.75
54A555	41.30	17.62	7.28
54A414	38.45	18.87	7.26
Pindar	41.15	17.16	7.08
Vidar	37.04	18.30	6.76

In this trial, the variety Pindar was also damaged by cyclonic winds.

54A-series and 55A-series seedlings were both planted in observation plots on a number of district farms. Their appearance under varying farming conditions and the maturity tests from these plots will assist in eliminating those with undesirable characteristics. This sequence was followed on by the autumn planting on district farms in 1960 of the leading canes of the 56A-series seedlings.

Rich and Poor Land Varieties

In pursuing the Bureau's policy of experimenting with varieties for special conditions, a number of varieties were planted on lands of higher and lower productivity. The "rich" land canes are assessed with particular reference to anti-lodging habit, while greater vigour is necessary for the "poor" land varieties.

Ratooning Experiments

The second ratoon crop of an observational ratooning trial containing three varieties, was

harvested in 1959 and the following yields were recorded for the three crops removed :—

Variety	Plant Crop Harvested	1st Ratoon Crop Harvested	2nd Ratoon Crop Harvested
	1957	1958	1959
Trojan	60.43	50.56	37.65
Pindar	62.32	46.84	35.49
Q.57	54.31	38.40	36.48

This observational trial did not take into consideration the varying seasonal conditions, but this was taken into account in a replicated quantitative trial in another Station field. In this latter trial, both plant and first ratoon plots of three varieties were harvested in 1959 as shown in table above.

The brittle variety Pindar was broken fairly extensively by the February, 1959, cyclone, the shorter ratoon plots being decapitated to a greater extent than the taller plant cane. This trial is being continued and returns from plant cane, first and second ratoons grown under the same seasonal conditions will be available in the 1960 harvest.

Field Day

On the 7th June, 1960, a well-attended Field Day was held at this Experiment Station. Visitors, totalling about 400, represented well over half the number of registered cane farms served by this centre. An inspection of the work of the Station and addresses by senior Bureau officers brought favourable comment from those who attended.

Laboratory Work

The total number of c.c.s. analyses carried out during the year was 1,233, and these were made up as follows :—

Experiment Station samples	678
Farm trial samples	525
Growers' samples	30
	1233

Variety	Cane (t.p.a.)		C.c.s. at Harvest		Sugar (t.p.a.)	
	Plant Cane	First Ratoon	Plant Cane	First Ratoon	Plant Cane	First Ratoon
Trojan ..	40.17	35.49	18.00	18.53	7.21	6.55
Pindar ..	35.36	31.73	18.93	18.49	6.69	5.86
Q.57	44.29	34.11	17.88	18.30	7.92	6.24
Means ..	39.94	33.78	18.27	18.44	7.27	6.22

Summary of Crops Grown on Station

	Tons	
Trojan	67.55	
Pindar	53.02	
Q.57	86.41	
Experimental varieties	553.58	
	760.56	
Plant cane harvested	428.41	
First ratoons harvested	260.24	
Second ratoons harvested	71.91	
	760.56	
Cane harvested for mill	760.56	
Used for samples, plants, etc.	44.00	
	804.56	
Total acreage harvested	21.80	acres
Average tonnage per acre	36.90	tons
Average c.c.s.	15.61	

Seedlings ready for planting out, Mackay Sugar Experiment Station.

Central Sugar Experiment Station

C. G. Story, Office in Charge

Notes on Weather and Crops in the District

The heaviest occurrence of fairly widespread frosts for a number of years was experienced during the last week of July, 1959, and continued until mid-August. Dry conditions prevailed from the beginning of July until November, when isolated storms and, later, general rains were experienced throughout the district during that month, although the amounts received were variable. The exceptions were Proserpine which had a useful fall in July, 1959, and localised areas at Walkerston and Flaggy Rock, which received relief rains in October, earlier than the other areas. Various parts of the district received good falls from the beginning of December, 1959, but towards the end of that month a cyclonic deluge yielded more than 11 inches in most coastal areas, making it the wettest December in Mackay since 1916. Despite this very wet month, below-average falls were recorded in eight other months of the year. The rainfall for the calendar year 1959 at the Sugar Experiment Station was 65.20 inches recorded on 152 days, being less than half the rainfall recorded for 1958. From the 1st July to 31st December, 1959, 17.09 inches were recorded on 45 days, the majority of this falling in December.

Torrential rainfall with some flooding occurred during periods in January and February, 1960, the Sugar Experiment Station being affected in this respect. Both months had above-average rainfall with January rainfall more than twice the average monthly registration for Mackay. March rainfall was below normal and general rain at two separate periods during May followed a drier April. Both of these months had

sudden weather changes to cool winter conditions with frosts occurring towards the end of May. The six-monthly period ended with a practically dry June experiencing heavy frosts in the last week of the month. A total of 63.26 inches of rain was registered on 77 wet days during the first six months of 1960.

The major portion of the district cane planting was completed by the third week in August, 1959, although portions of Proserpine area and Mackay north coast were well behind schedule. Cane planted during June experienced cold weather conditions and had a very delayed germination with some failures. The blocks planted during July and August gave a satisfactory germination, although some were slow and rain would have assisted in this respect. Generally dry conditions continued throughout the district in October and plant cane made slow progress until rain in November and December.

Despite dry conditions for harvesting, no deterioration of millable cane occurred and the early termination of the harvest offset any tendency in that respect. The ratoons of later harvested blocks made better progress than those from the earlier ones. Crops made good growth following rainfall in November, 1959, with an acceleration to excellent progress under the ideal growing conditions which were experienced in December, 1959, but prolific growth of grass occurred in many blocks following that month's heavy rainfall.

Optimum conditions for growth continued during January and February and by mid-March, 1960, most cane crops were well advanced, except those on neglected blocks or on lower country which were retarded, first by the

An experiment at Mackay Station to determine the possibility of chlorotic streak transmission by nematodes.

dry spring or late planting, and later by water-logged conditions.

The 1960 early planting programme commenced on schedule with favourable weather conditions prevailing for planting by the end of March and throughout April. Cane planted during this period germinated well and had made good progress by the end of June. Planting was interrupted by rain in May, and subsequent cold conditions delayed germination of cane planted then and during June, 1960. A majority of the growers took advantage of the drier conditions in an attempt to complete their plantings before the commencement of the harvesting season. It was not a heavy arrowing year, except for N.Co.310. The estimated crop for the eight mill areas is slightly in excess of peaks, which is a contrast to the marked over-production in 1959. Reduced plantings, lighter fertilizer application, neglected blocks and less favourable weather conditions, have all combined to restrict the district's production for the 1960 harvest.

1959 Crushing Season

This terminated on the 18th November, when Proserpine mill was the last to cease operations. Ideal harvesting conditions prevailed for the period of the season which was less than 18 weeks for most mills. The high average c.c.s. was an outstanding feature of the season, with a resultant lower tonnage needed to produce mill peaks. Another major factor in reducing the length of the season was the lack of interruption by rain, in some cases the lowest for more than 20 years. Proserpine was the only mill area to have consistent rains in the early part of the season with consequent lost time.

RAINFALL RECORDS, 1935-1960.

Year	Rainfall (inches)	Year	Rainfall (inches)
1935-36 ..	99.57	1948-49 ..	46.95
1936-37 ..	64.21	1949-50 ..	85.48
1937-38 ..	47.21	1950-51 ..	107.63
1938-39 .	61.29	1951-52 ..	41.68
1939-40 ..	82.86	1952-53 ..	56.58
1940-41 ..	73.71	1953-54 ..	102.57
1941-42 ..	57.75	1954-55 ..	129.44
1942-43 ..	76.13	1955-56 ..	82.27
1943-44 .	58.67	1956-57 ..	55.87
1944-45 .	33.53	1957-58 ..	133.09
1945-46 ..	68.52	1958-59 ..	61.60
1946-47 ..	48.09	1959-60 ..	80.35
1947-48 ..	38.40		

Average for 25 years = 71.74.

Pests

Damage to the 1959 crop from both greyback and frenchi grubs was assessed as light to

Abstract of Meteorological Observations made at the Central Sugar Experiment Station, Mackay, from 1st July, 1959, to 30th June, 1960.

Month	Rainfall (inches)	No. of wet days	Shade Temperatures						Mean Diurnal Range	Mean Temp. 9 a.m.	Mean per cent. Rel. Humidity 9 a.m.
			Maximum			Minimum					
			High	Low	Mean	High	Low	Mean			
1959											
July	0.36	6	82	65.5	73.1	64.5	33.5	50.31	22.79	64.16	70.42
August	0.26	6	82.5	71	76	63	38	48.21	27.79	65.06	64.55
September	0.17	4	89	74	79.58	65	43	56.05	23.53	72.60	63.9
October	0.27	3	92	79	83.52	71	51	58.98	24.54	77.67	53.90
November	3.21	10	93	79.5	84.50	72	59	66.09	18.41	79.50	66.72
December	12.82	16	93.5	80	88.11	76.5	67.5	72.00	16.11	83.14	74.27
1960											
January	32.77	23	90	72.5	84.05	77.5	66.5	71.65	12.40	79.68	79.37
February	15.61	16	91.5	76	86.12	74.5	67.5	71.21	14.91	81.41	76.29
March	8.61	14	91.5	78.5	82.89	71	61	67.19	15.70	78.23	75.03
April	1.26	10	86	77.5	81.42	70.5	52.5	63.3	18.12	75.2	75.62
May	4.28	8	86.5	66.5	75.72	71.5	40	54.82	20.90	67.68	70.85
June	0.73	6	79.5	65.5	72.97	60	34.5	49.95	23.02	63.47	89.17
Totals	80.35	122									

The application of bagasse for improving the tilth of low-lying soils at Mackay.

Bagasse on left, filter mud on right. A continuous search for methods of improving soil fertility

negligible. The area treated with BHC for 1959 was less than the reduced area treated in 1958. Heavy beetle flights occurred from late November, 1959, to January, 1960, and severe grub damage was reported at Carmila and Septimus in May, 1960. Rat damage was light in 1959, but large rat populations were present in crops to be milled in 1960. Wallaby damage was light and took place in fields in outlying areas. Coots were troublesome but shooting and poisoning were used as methods of control. Minor occurrences of large moth borer, sugar cane scale, army worms and soldier fly were noticed, while funnel ants were present in the Proserpine, Cameron's Pocket and Richmond areas, and Rhyparida in the Kelsey Creek area. Counts obtained from numerous soil samples collected from areas of poor cane showed that high populations of nematodes were present.

Diseases

Chlorotic streak disease is a major problem in the district, the number of farms infected having increased. The results of trials showed that losses are experienced with all the major varieties in the area. Field losses are severe when diseased planting material is used, especially in the variety Q.63.

The policy adopted in the campaign for the control of mosaic disease in the Farleigh-Habana area has proved effective and with a determined adherence to this policy, mosaic disease should be relegated to a position of minor importance within three years.

An earlier, inadvertent transfer of dwarf disease in planting material to the Glenella area was, unfortunately, not discovered until recently. By then further plantings had propagated the disease extensively on seven properties in the Farleigh mill area, but the position is now in hand. Odd stools of dwarf disease also occurred in the Bakers Creek-Rosella area and on one farm at Carmila.

Leaf scald disease re-appeared in the Mackay-Proserpine district after a lapse of nearly 20 years. It was discovered in the variety Q.63 on three farms in the Richmond area in Mackay and on four farms in the Hamilton Plains area of Proserpine during May, 1960.

Bacterial mottle disease is severe on the susceptible variety Q.57 and is prevalent on country subject to flooding. It was noted that many varieties outgrew yellow spot and that the symptoms were absent in the new growth after the wet season.

Close attention is necessary to ensure clean plantings and that full use is being made of all cane available from the annual hot water treatment campaigns (50°C. for 3 hours), since contamination with ratoon stunting disease has occurred in cane treated previously.

Miscellaneous district notes

The variety Q.63 further enhanced its reputation for excellent sugar content during the 1959 season. In addition to the high average c.c.s. received by canegrowers generally with this variety, one Proserpine mill supplier from Elaroo obtained tests of 19.7, 20.5, 20.85 and 21 c.c.s. at the end of October, 1959, a record for the State. Many canegrowers are more conscious of the value of planting varieties for high c.c.s. throughout the season.

The high district and individual farm production averages per acre obtained during 1959 emphasised the advantages of producing good crops of cane on smaller areas by proper farm husbandry. Intensive farming practices are superior to extensive farming practices in sugar cane. It was very noticeable that reduction of fertilizer applications resulted in uneconomical production, irrespective of the variety. Nitrogen is one plant food which is a necessity and adequate requirements need consideration, especially since cheaper forms of nitrogen are now available.

The first district aerial spraying with the weedicide 2,4-D for the control of bellvine occurred in February, 1960, when five acres in the Te Kowai area were treated.

Canegrowers became interested in beef cattle production following restrictions in sugar production to peak harvests.

Stunted growth due to copper deficiency on a Mackay soil.

EXPERIMENT STATION OPERATIONS

Seedling Raising

A total of 8,385 seedlings representing 58 crosses was planted in the field during late July —early August, 1959. These were raised from cane seed planted in the glasshouse early in March, 1959. Included as one parent in approximately half of the crosses were approved varieties originally developed at this Experiment Station for the central district. They have produced a good class of seedlings for selection in 1960.

Annual Seedling Selection

Selection of seedlings planted in the field in July-August, 1958, resulted in the following plantings being made during 1959 : (1) a total of 223 seedlings representing 48 families planted in 30-sett plots for comparison with the standard Q.50, (2) a total of 662 seedlings representing 60 families planted in 4-sett plots, (3) a total of 72 seedlings representing ten families selected from stalks of bunch-planted seedlings for 2-sett plantings. In addition, 22 introduced varieties were hot water treated at 50°C. for three hours and planted in 30-sett plots.

Progressive Seedling Trials

The first ratoon crop of the replicated yield observation trial with 38 of the 1954 series seedlings and the varieties Q.61, Q.69, Q.70 and Vesta was harvested in October, 1959. Thirteen of these seedlings were selected for observation plantings on 12 properties in the district, while four of these seedlings selected as possible better-land canes were planted on another three farms.

The replicated yield observation trial, with 30 of the 1955 series seedlings and the varieties B.45/151, C.P.38/34, C.P.50/11, C.P.51/27 and 40S.N.746, planted in 1958, was harvested at the end of September, 1959. This group of

seedlings was not outstanding in any respect in the plant crop. Final selection of any canes which justify further trial will be made on the first ratoon crop in 1960.

Fifty-eight of the 1956 series seedlings, selected from first ratoon 20-sett plots, were planted in a replicated yield observation trial with Q.58 as the standard.

A general distribution of the variety Q.73 was made during 1959 and this variety was added to the approved lists for the eight central district mills in January, 1960.

Variety Introductions

Three cane varieties released from the Bureau's Brisbane Quarantine House during 1959 were planted on the Experiment Station. These were B.49/377, B.52/405, B.52/407. In addition, 12 advanced seedlings and 17 introductions were received from the Sugar Experiment Stations at Bundaberg and the Lower Burdekin. These are being propagated for planting in progressive trials for assessing their value in comparison with local commercial varieties.

Long Term Trash Trial

Eight crops of this trial, which was commenced in August, 1949, have now been harvested. Throughout this period there were no significant differences in tonnage due to trash conservation on this particular trial site.

Experiments with Bagasse and Deep Ripping

Although this trial was affected by poor growth areas, which appeared in one of the bagasse treated plots in the 1959 first ratoon crop at the second cycle, the overall results indicate some benefit from the bagasse treatment and deep ripping. Five crops have now been harvested from this trial which was initiated in 1953. The total tonnages per acre of cane harvested from each treatment since the inception of the trial are :

Bagasse, plus deep ripping	123.1	tons per acre
Ripping only	120.14	tons per acre
Control plots — No bagasse/no ripping	110.97	tons per acre

Aqueous Ammonia v. Sulphate of Ammonia Trial

The results of a preliminary replicated 3 x 9 trial to assess the potential value of aqueous ammonia for application to sugar cane in comparison with sulphate of ammonia indicated the possibilities of the former material. Unfortunately variable injections did not allow a valid comparison being made between equivalent amounts of N, but the yields obtained gave increases for both sulphate of ammonia and aqueous ammonia above the control plots, which were significant at the one per cent. level. The trial was again planted in 1959 with a modified injection machine using equivalent amounts of N for both the sulphate of ammonia applied by hand and the aqueous ammonia applied by machine.

Urea in Hot Water Treatment Tank

Trials to test the effectiveness of urea added to the hot water treatment tank in increasing the germination of the hot water treated setts did not yield any significant results with the varieties Q.50 and Q.68.

Legumes

Hundreds of individual plant selections were made and bulk seed collected from progeny of the 12 crosses planted in separate plots for purification purposes. Malabar, Black Eye 5 and C.P.I.12153 performed well as parents. Weights of green material obtained gave tonnages per acre ranging from 18.8 to 19.3 for the heaviest five crosses. Heavy frosts at the end of June, 1960, affected ten of the crosses. In addition some were planted on low, wet country, and individual selections were made of the best plants which survived the wet conditions. The cowpea crosses maintained cover longer than velvet bean growing under the same conditions. Malabar cowpea did not outyield the crosses but was superior to Black Eye 5 and Santiago in the same block. Nematodes affected Malabar.

Weedicides

TCA at the rate of 20-24 lb. per acre and used at a strength of 1 lb. in 3 gallons of water was effective for long-term control of young

grass on headlands adjacent to cane blocks when applied in March, 1960. Dalapon in three split applications, each of 1 oz. per gallon, at short intervals appeared better than one application of 3 oz. per gallon. Heavy growth of sensitive weed, *Mimosa pudica,* in pastures and cane blocks was controlled by spot spraying with 1 gallon of 40 per cent. 2,4,5-T in 270 gallons of water. The plants lost most of their sensitivity within 24 hours. Growers showed increased interest in the chemical control of nut grass, *Cyperus rotundus,* and winter weed, *Ageratum conyzoides.*

Leaf scald disease in Q.63.

Junior Farmers Sugar School

This successful school was conducted at the Central Sugar Experiment Station from the 22nd to the 26th February, 1960. Altogether there were 33 Junior Farmers present.

Field Day

The attendance of 250 persons at Field Day on the 28th June, 1960, was the lowest for some considerable time.

Laboratory Work

The following is a summary of the c.c.s. analyses carried out during the year:—

Experiment Station	1,126
Farm Trials	445
Growers' Samples	160
Show Canes	53
Standover Samples	39
	1,823

Summary of Crops Grown on Station

Varieties harvested during 1959 *Season* :

	Tons
Q.50	151.71
Q.58	107.59
Q.68	74.36
Q.63	50.56
Seedlings	348.37
	732.59
Plant Cane harvested	271.22
First Ratoon Cane harvested	282.26
Second Ratoon Cane harvested	179.11
	732.59
Total Cane harvested for mill	732.59
Used for samples, plants	22.95
	755.54
Total acreage harvested	30.44
Average tonnage per acre	24.82
Average c.c.s.	16.07

An aerial view of Bundaberg Sugar Experiment Station.

Southern Sugar Experiment Station

H. G. Knust, Officer in Charge

Weather Notes

Variable weather conditions prevailed throughout the year. Good rains in July, 1959, ensured that soil moisture would be satisfactory during the critical spring period. No follow-up rains occurred, and by October, when relief rains fell, crops on the non-irrigated farms were showing distress from dry weather. Good growing conditions then prevailed until the end of January. Unseasonal dry and hot conditions experienced during the greater part of February were followed by soaking rains accompanied by strong winds during the latter part of the month. Autumn conditions, however, were again unusually dry and cool, and further rains did not fall until the end of May. These provided sufficient moisture for crop needs until the end of June. Better-than-average rainfall, 50.17 inches, was recorded for the year. Light frosts which occurred in July and August, 1959, and in May, 1960, caused only superficial damage to foliage but sharp frosts toward the end of June severely damaged young plant cane and caused some damage to mature crops in low-lying areas.

Crop Notes for 1960 Season

Germination of spring-planted cane was slow and patchy early due to low soil moisture, but improved when optimum soil moisture was restored late in October. Final stands were good. A satisfactory rate of growth was maintained in both the spring plant and the earlier autumn plant cane until the advent of abnormally unfavourable autumn conditions when the growth rate gradually decreased; however, recovery was reasonably good after rain fell at the end of May, 1960, and yields should be satisfactory. Ratooning was slow and patchy early after harvest, improving to fast and uniform with increased soil moisture and temperature. Partial failures were again recorded on

some farms with a poor ratooning history. In some instances reduced quantities of fertilizer, particularly nitrogen, were applied to ratoons, and in consequence many of these crops were not as well grown as in recent years. Furthermore irrigation was not always regularly practised, chiefly in an endeavour by growers to keep yields down because of over-production. Some sprawling and partial lodging occurred in standover and well-grown plant crops as a result of wind storms of short duration in February and May, but for the most part crops remained erect. There was some light flagging in N.Co. 310 and C.P. 29/116, particularly in areas close to the coast, but present indications point to arrowing being light in the majority of crops this season.

Preliminary estimates for the 1960 harvest in the Bundaberg-Isis area amount to 1,919,885 tons from 72,464 acres.

RAINFALL RECORDS, 1915-1960.

Year	Rainfall (inches)	Year	Rainfall (inches)
1915-16 ..	28.54	1938-39 ..	41.01
1916-17 ..	58.08	1939-40 ..	41.69
1917-18 ..	49.85	1940-41 ..	43.26
1918-19 ..	24.24	1941-42 ..	33.52
1919-20 ..	28.20	1942-43 ..	40.75
1920-21 ..	45.16	1943-44 ..	45.22
1921-22 ..	44.97	1944-45 ..	28.14
1922-23 ..	37.14	1945-46 ..	26.10
1923-24 ..	34.16	1946-47 ..	44.52
1924-25 ..	50.96	1947-48 ..	57.76
1925-26 ..	37.62	1948-49 ..	40.18
1926-27 ..	68.18	1949-50 ..	59.31
1927-28 ..	74.69	1950-51 ..	50.74
1928-29 ..	31.16	1951-52 ..	40.42
1929-30 ..	43.16	1952-53 ..	48.99
1930-31 ..	47.19	1953-54 ..	45.81
1931-32 ..	22.88	1954-55 ..	73.95
1932-33 ..	36.81	1955-56 ..	71.13
1933-34 ..	71.45	1956-57 ..	28.01
1934-35 ..	40.01	1957-58 ..	57.05
1935-36 ..	44.24	1958-59 ..	45.24
1936-37 ..	31.65	1959-60 ..	50.17
1937-38 ..	44.40		

Average for 45 years = 44.61 inches.

Prospects the 1961 Season

Cane planted during the summer and early autumn months of 1960 germinated well. Germination was not affected where considerable quantities of organic matter — residues from millable crops destroyed after the 1959 harvest — were present in the soil at planting time. All were showing good growth by mid-June, 1960, when many were cut back by sharp frosts and they will need favourable growing conditions in the future to enable them to produce the good yields normally expected from autumn-planted cane.

Harvesting the 1959 Crop

Harvesting of the 1959 crop began in the Millaquin area on 2nd July, and by the end of July crushing was in progress at all mills in the Bundaberg-Isis district. Ample cane supplies were maintained to all factories and any delays caused by wet weather were of little consequence. Crushing was completed at all mills by the end of the third week of December.

Heavy carry-over crops which remained after the 1959 harvest posed a problem for canegrowers. Large acreages of cane were considered unsuitable for standover purposes and growers employed various means for disposing of these crops. Rotary hoes, forage harvesters, bulldozers and weighted offset discs were used fairly successfully.

Alternative Crops

Many canegrowers planted fallow fields with cotton and tobacco. Cotton planted on the friable, better-class forest soils produced some good crops and once the management of this crop is better understood its acreage may extend. With an assured market, cotton could be the means of providing additional income to those canegrowers who have an embarrassingly low sugar peak. Good crops of tobacco were produced from suitable soils. However, only a limited number of canegrowers were interested in growing this crop because of the lack of suitable soil and the capital outlay involved.

Abstract of Meteorological Observations made at the Southern Sugar Experiment Station, Bundaberg, from 1st July, 1959, to 30th June, 1960

Month	Rainfall (inches)	No. of wet days	Shade Temperatures						Mean Diurnal Range	Mean Temp. 9 a.m.	Mean per cent. Rel. Humidity 9 a.m.
			Maximum			Minimum					
			High	Low	Mean	High	Low	Mean			
1959											
July	2.50	5	73	60	69.65	61	38	51.12	18.53	60.65	81.48
August	0.70	3	80	67	72.50	58	39	48.10	24.40	61.40	72.60
September	0.99	6	81	72	75.65	66	45	56.17	19.48	69.65	73.39
October	5.07	9	85	66	77.20	68	48	58.93	18.27	60.56	69.70
November	6.28	12	86	69	80.80	69	59	63.93	16.87	75.85	77.83
December	5.61	7	88	79	84.90	75	65	70.00	14.90	81.04	74.65
1960											
January	10,83	12	87	80	82.81	75	61	70.00	12.81	79.89	80.52
February	8.89	12	89	72	83.88	76	65	69.55	14.33	79.95	82.45
March	0.99	8	88	74	81.61	72	59	60.42	21.19	76.00	80.30
April	2.38	8	86	76	80.27	68	45	60.63	19.64	70.35	79.07
May	5.63	6	80	66	68.00	68	40	52.62	15.38	63.62	76.10
June	0.30	4	76	62	71.16	57	34	47.20	23.96	60.14	79.47
Totals	50.17	92									

Aerial Application of Weedicides

Aerial application of weedicides was practised for the first time in this district. Approximately 600 acres of standover and well-grown cane infested with *Ipomoea quamoclit, I. plebeia, Cucumis sativus* and *Crotalaria goreensis* were treated with 2,4,5,-T with varying degrees of success.

Pests

Minor outbreaks of army worms were kept under control with normal applications of DDT.

Some damage by grubs of the Childers beetle occurred during the early summer months. Trichosterna and frenchi grubs were responsible for some light damage in forest and sandy loams, but severe damage occurred on a few farms. Fumigation with carbon bisulphide was practised in small localized spots where it was considered economical, and ploughing out recommended where cane was poorly grown over larger areas. BHC trials were continued against the larval stages of all species. Control in the plant crop was recorded against the Childers grub with BHC at rates of 4 and 8 lb. gamma isomer per acre ploughed under prior to planting.

Scale insects were fairly prevalent, undoubtedly due to the unusually large area of standover crops. Crop losses due to nematodes were further investigated and in addition to a variety resistance trial embracing 13 varieties, nemagon trials were established against the root-knot nematode.

Some success was achieved against soldier fly larvae which were again observed in association with patchy ratooning. In one trial control was obtained where BHC, at rates of 4 lb. and 8 lb. gamma isomer per acre, had been broadcast on the field and worked into the surface during the autumn of 1958, about the time when the insects were emerging. Further trials were established with lindane, dieldrin and DDT applied by means of a boom spray.

Diseases

Stocks of planting material, hot water treated at 50°C. for three hours, were maintained by the Cane Pest and Disease Control Boards, and

distribution of disease-free cane was made to growers during the planting periods of 1959 and 1960. Chlorotic streak disease was still confined to the poorly drained lands and appeared to be restricted to those fields in which it occurred previously. Mosaic was discovered in the Booyal district and appropriate action was taken to bring this disease under control. An outbreak of leaf scald appeared in Q.63 and quarantine measures and roguing were instituted on all affected fields.

EXPERIMENT STATION ACTIVITIES

Annual Seedling Selection

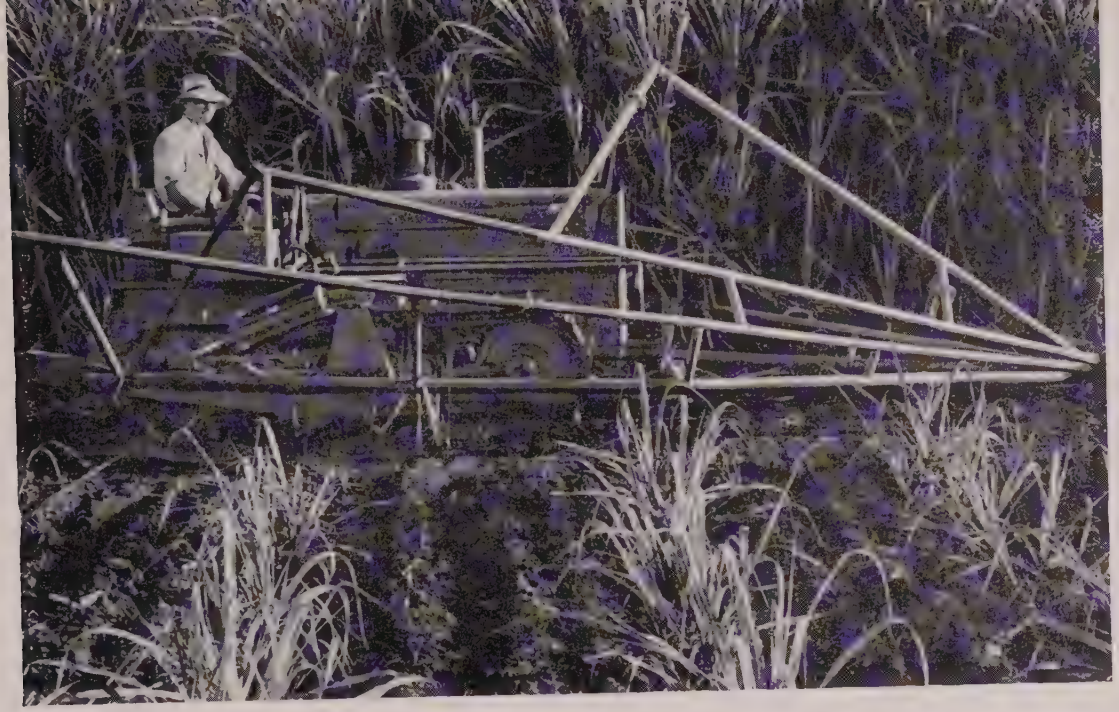
Selections were made from the 1958 series seedlings when the top-ranking 130 were selected for planting in 30-sett plots and a further 362 selected for planting in 4-sett plots. Of the 59 selections from the 1957 series seedlings in 30-sett plots, 32 were planted in a replicated yield observation trial and 27 were transferred to the Isis introduction plot for planting in 30-sett plots. Selections from the 1956 series seedlings planted in 40-sett plots totalled 16, of which nine were included in a replicated yield observation trial and seven were transferred to the Isis introduction plot.

Introduction Plot and Isolation Nursery

An introduction plot was established on a farm near Cordalba, for the purpose of increasing varietal selection work in the Isis district where conditions indicate the need for a variety suitable for the harsher conditions of the dry, hilly areas.

Ninety canes were transferred from the Experiment Station to the Beerwah isolation

A forage harvester being used to destroy unwanted cane at Bundaberg.



A break-pusher for controlling the pre-harvest burn, at Isis.

The Fairymead four-row planter.

nursery for ultimate planting and trial in the Moreton district. These included the 1956 and 1957 series seedlings and canes introduced from other countries.

Replicated Randomised Trial

Two replicated randomised trials were harvested during the year. The plant trial embraced the 1954 and 1956 series seedlings, some of which showed promise and were long hot water treated in anticipation of final selection in the ratoon crop in 1960. The 1955 series seedlings contained in the first ratoon trial did not produce any cane with sufficient promise to warrant selection.

A replicated randomised trial planted in the spring of 1959 included 1956 and 1957 series seedlings selected from the 30-sett and 40-sett plots.

Red Rot-Ratooning Trial

All 1954 and 1956 series seedlings canes selected for inclusion in the replicated yield observation trial were planted in this trial in 1958. Examination of the canes before harvest indicated that two of the 1954 series seedlings were susceptible to red rot. Another ratooned poorly after harvest. In the ratoons, an examination of the canes before harvest indicated that five of the 1955 series seedlings were susceptible to red rot, two being highly susceptible.

Legumes

The cowpea breeding project advanced a stage further when 536 selections were made from 11 crosses of the F6 generation for inclusion in observation trials in 1960-1961. Bulk pickings were also made from each cross for further planting for seed purification if considered necessary. Three crosses, C.P.I. 12153 x Malabar, C.P.I. 12153 x Black Eye 5 and Malabar x C.P.I. 9247 gave exceptionally long cover, extending into the winter months.

Annual Field Day

Approximately 450 canegrowers, mill officials and other persons interested in the sugar industry attended the Station for Field Day on 30th June, 1960. All visitors were considerably impressed by the Station's activities and listened attentively to the addresses delivered by the Assistant Director and other representatives of the sugar industry. A large display of tractors and implements provided by the trade suitably diversified the day's proceedings.

Laboratory Work

The following is a summary of cane and water samples tested during the year :

Station and trial cane samples	1784
Farmers' cane samples	340
	2124
Irrigation waters	190

Summary of Crops Grown on Station

	Tons
Seedlings	587.19
C.P.29/116	6.53
N.Co.310	6.56
Pindar	6.52
Q.47	145.60
Q.49	6.52
Q.50	166.48
	925.40
Plant cane harvested	379.31
Ratoon cane harvested	546.09
	925.40
Total cane harvested for mill	907.01
Used for samples and plants	18.39
	925.40
Total acreage harvested	21.99 acs.
Average tonnage per acre	42.08 tons
Average c.c.s.	13.27

The Plant Breeding and Entomology laboratory at Meringa Station. Wild canes flowering at right.

Division of Plant Breeding

J. H. Buzacott, Senior Plant Breeder

Introduction

One of the great handicaps to the expansion of the cane breeding programme has been the lack of suitable land at the Northern Sugar Experiment Station on which to conduct experiments. This has now to a large extent been remedied by the purchase of an additional 13 acres of poor but reasonably uniform forest land on which considerable expansion of the selection programme will now be possible. This land has been completely cleared and planted with an initial cane crop to indicate irregularities which may need correction before experimental work is conducted. The first planting on this land was made late in 1959 and a very uniform crop resulted which has been harvested and partially ploughed out to make way for selections to be planted next year. About two acres of the new land, some of which had grown cane before, was prepared ready to be planted with selection plots in July, 1960. In all other aspects the cane breeding work has been progressing well and it is very satisfactory to note that each year at all stations more varieties are appearing which equal or better the yields of standards in advanced selection plots.

Cross-pollination

The critical rainfall prior to flowering was rather restricted. Following on seven inches in December, 1959 there was heavy rain, amounting to 23 inches, in January, but the falls in February and March, of nine inches and ten inches respectively, were well below average and the 46 points recorded in April were almost an all time record low. This distribution of rain, coupled with the many other factors which influence flowering in sugar cane, was responsible for the early and free flowering which was experienced in 1960. Not only was it free and early but the flowering terminated at a much

earlier date than usual. In consequence cross-pollination was a brief but exceptionally busy period. The first cross was erected on the 12th May and the last on the 14th June, with a total of 376 crosses of which seven were large area crosses. In accord with the unusual season, a number of varieties behaved abnormally. Co.331, Eros and G.362, which are commonly good pollen producers, could only be used as females this year, whilst Co.270 and Pindar produced considerable amounts of pollen, the latter grading as high as 15 per cent. a figure which, according to our records, it has never achieved before. Seed ripened somewhat more slowly than usual but excellent germinations in the glasshouse from the new seed indicate that adequate quantities of seed were set.

Stored seed is playing an important part in our cross-pollination programme and this year seed produced in 1956, and kept in a deep frozen condition, was sown and germinated well. Following the introduction of deep-freeze seed storage a few years ago, the space available was found insufficient and accordingly in 1959 an additional deep-freeze unit of 16 cubic feet capacity was purchased and put into immediate service for the storage of seed.

Modification of Solution

As mentioned in the 1959 Annual Report, tests were carried out in that year with the modified solutions which had been successfully tested in Hawaii. Following our successful trials, one of these solutions was adopted this year and all crosses were made in the new mixture which consists of 100 p.p.m. sulphur dioxide, 50 p.p.m. phosphoric acid, 25 p.p.m. sulphuric acid

Untying the bottoms of lanterns —a daily task during the cross pollination season.

and 25 p.p.m. nitric acid. The use of this modified solution eliminated the topping up of solutions on Sundays which was formerly necessary.

Control of Flowering

The lighting system installed at the Northern Sugar Experiment Station for the photoperiodic control of flowering was considerably extended and seventeen varieties were accommodated under the illuminated area this year. The exceptionally early initiation of flowering in 1960 may have been responsible for the lack of response of some of the included varieties to photoperiodic control but it was quite effective with eight of them, viz., Co.270, Co.421, C.P.36-111, C.P.38-34, C.P.44-101, Eros, N.Co.310 and Q.58.

Maleic hydrazide spray has been incorporated as a standard practice for the delay of flowering in certain varieties but this year CMU was also used for this purpose. This follows reports of the success in Hawaii of high concentrations of CMU to prevent flowering and of lower concentrations in the Philippines to induce it. In our experiments, success was attained in the delay of flowering but not in its induction. Delay was achieved in three varieties, Co.270, M.336 and N.Co.310, using 5 lb. per acre of 80 per cent. CMU. Two methods of application were used — leaf application and soil application —and both were successful in the delay of flowering.

Further experiments in the gravimorphic control of flowering were also performed. It was hoped to confirm the promising results obtained in 1959 and, with this end in view, stalks of a number of varieties growing in the field were bent into a horizontal position and retained in that orientation for several weeks. Unfortunately, the experiment was quite inconclusive. All varieties used, except U.S.48-34,

Parent varieties illuminated to delay arrowing.

were too brittle to withstand the treatment and cracked at the nodes which resulted in the death of the growing point. U.S.48-34, which in past years flowered sparsely and not early, this year flowered very freely and very early and, in consequence, the experiment lost any significance in this variety because the control stalks all flowered. It is intended to repeat the experiment next year with the varieties grown in drums in which the stalks can be retained in the horizontal position without risk of breakage.

Seedling Raising

Germination of seed was good at all stations with the exception of the Lower Burdekin where the germination was slow and somewhat erratic. This was attributed to the cold temperatures experienced and the inadequate artificial heating of the glasshouse. This position has now been remedied by the installation of more effective heating equipment which it is anticipated will result in better germination at the Lower Burdekin Station in 1960.

At Meringa, 5,726 seedlings were single-planted and some 27,650 in bunches giving an approximate total of 33,400 seedlings. At the Lower Burdekin, 6,120 seedlings were single-planted and 10,540 in bunches giving a total of 16,660 seedlings. At Mackay, 8,385 seedlings were single-planted and at Bundaberg the number was 4,924. Accordingly, the grand total of seedlings planted at the four stations in 1959 was some 63,000.

Selection

Selection at the Northern Experiment Station was complicated by the experimental work on selection rates and plot size, also by the bunch-planting experiments which still continue. The

The glasshouse and some of the seedling tables at Meringa.

total number of selections planted was 2,964 in 2-sett plots, 2,311 in 4-sett plots, 467 in 30-sett plots and 33 in a yield observation trial.

At the Burdekin Station, 249 seedlings were selected from single-planted originals, 51 of which were planted in 40-sett plots and 198 in 4-sett plots. In addition, 63 varieties were selected from 2-sett plots derived from bunch-planting and planted in 40-sett plots, whilst 171 from the same source were planted in 4-sett plots. Thirty-two introductions, either from overseas or from other stations, were also planted in 40-sett plots.

At Mackay, 223 varieties were selected and planted in 30-sett plots and 662 in 4-sett plots. In addition, 72 varieties were selected from bunch-planted seedlings and planted in 2-sett plots. A total of 22 introductions was also planted in 30-sett plots.

At Bundaberg Station the numbers selected were 130 seedlings for planting in 30-sett plots and 362 for 4-sett plots.

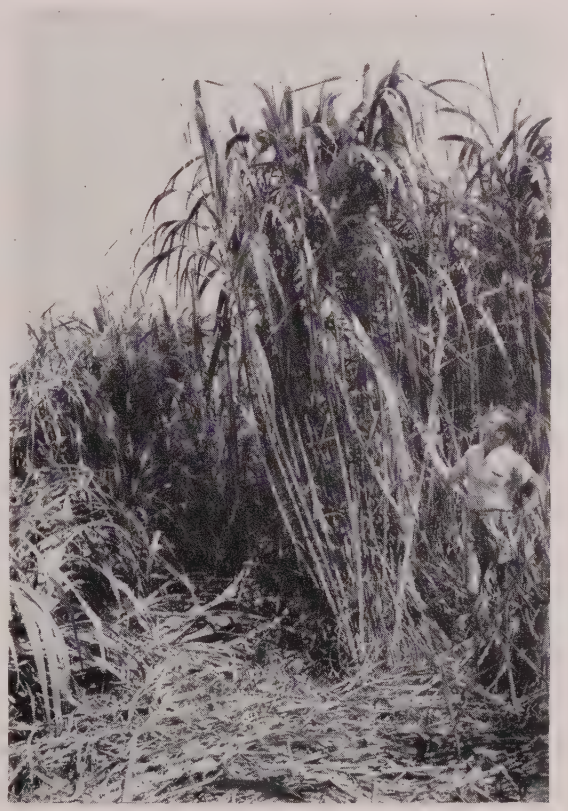
Rich Land Selections

The development of varieties suitable for rich land planting has assumed greater importance and during the 1959 planting season 745 seedlings from the cross Q.67 x M.336 were planted on rich land, 497 of them in 4-sett plots and the remaining 248 in 2-sett plots. On another rich land site, 28 selections were planted in 30-sett plots and ten in an unreplicated yield observation trial with Q.66 and Q.67 as standards. Some of these varieties, particularly in the 30-sett plots, show a good deal of promise and a number have remained erect in spite of severe lodging of many other varieties in the vicinity. It is hoped with this greater emphasis on the testing of selections from specific crosses on rich land, we will be able to add to the all too few rich land types at present available on the approved variety list.

Sub-stations

The major sub-station at Mourilyan in the far north was maintained on a full scale. There, 1,618 selections were planted in 2-sett plots, 184 in 4-sett plots, 114 in 30-sett plots and ten in 180-sett plots. This sub-station is well developed and many varieties from it are now going into farm propation observation trials. Since this station also, to a large extent, will serve the Babinda area, the sub-station at Bartle Frere is being allowed to lapse and the planting there was reduced to 45 varieties in 30-sett plots and 41 varieties in a yield observation trial. It is not proposed to make any further planting on this sub-station in 1960.

Variety testing was expanded also in the north by developing sub-stations at Tully and Ingham. At the former place, 43 varieties from the Innisfail sub-station were planted in 40-sett plots whilst at Ingham, 73 varieties were introduced to the Abergowrie area from the Northern Experiment Station, 33 from Ayr, 27 from Mackay and eight from Bundaberg.



54N6434 is promising for rich lands.

In the south the introduction plot was maintained at Beerwah and plans were implemented to increase variety introductions to the Isis district. At Beerwah, thirty-two 57-series seedlings, twelve 56-series, eight 55-series and forty-six overseas varieties were introduced from the Southern Experiment Station. From the same source, twenty-seven 57-series, seven 56-series, one 53-series, four "N" series and 22 overseas varieties were introduced to the Isis district whilst the Gin Gin district also received especial attention with regard to introductions on account of the drought problem which exists there.

Although it is not possible to establish full sub-stations in all districts, nevertheless far more varieties than ever before are now being introduced into all mill areas and the result of this expanded programme should soon be apparent as varieties more adapted to specific environments are developed.

Selection Experiments

Experimental work on methods of selection was continued. Investigational work on bunch-planting has been conducted a further stage. It will be several years before this method can be properly evaluated in comparison with single-planting. In the meantime, bunch-planting has been adopted as a standard practice at the Northern and Lower Burdekin Stations for at least a part of the seedling raising programme, whilst at Bundaberg it will be introduced this year as a standard practice for providing seedling varieties for autumn planting on that station. This practice will bring future selection material at Bundaberg into a better comparison with varieties developed from commercial planting practices in that district.

Detailed studies of border competition between adjacent varieties in small plots were continued during the year. As a result of this work, it is

Velvet bean badly affected by wilt, an added incentive to continue the legume breeding programme.

now concluded that 3-row 0.01 acre plots are satisfactory for replicated variety trials despite border effects. These small plots are now used instead of the larger 0.05 acre plots used formerly for replicated trials on the Experiment Station and on farms.

Competitive effects were found to be very important in 4-sett and 2-sett plots and further work is in progress on this subject.

Further experiments confirmed the value of selecting a higher proportion of original seedlings. More than half the varieties selected for planting on farms in 1960 might have been discarded at the original seedling stage under the old system of selection.

The replacement of the randomized blocks trial with a lattice squares trial, as the stage following 30-sett plots, has shown most promising results in the first year of its use and the indications are that it will prove more efficient than the randomized blocks trial.

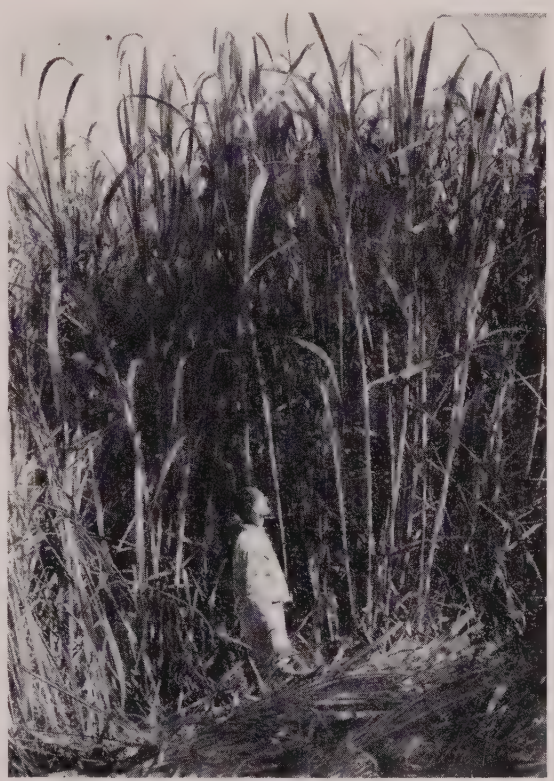
Resistance to lodging is a most important character for varieties to possess, which are to be grown on rich land, and assumes even greater importance with the extension of mechanical harvesting. Investigations into methods for the measurement of resistance to lodging in sugar cane varieties were continued. It has been found that lodging resistance is correlated with the force required to move stalks sideways through a fairly small angle. The term physical lodging resistance is proposed for the varietal character estimated by the measurements. These measurements are being used as an aid to select varieties resistant to lodging.

Legume Breeding

The legume breeding project was continued and seed from the earlier crosses has now reached the F6 generation. Superior clones have been selected and planted out in the four major districts of the state. The best crosses for all districts appear to be Havana x Black Eye 5, Havana x Malabar and Malabar x Black Eye 5. A character of importance to be studied in subsequent selection is harvesting qualities of the seed. Some further crosses were made during the year and seed from these is being distributed to other stations at the F2 stage.

Varietal Statistics

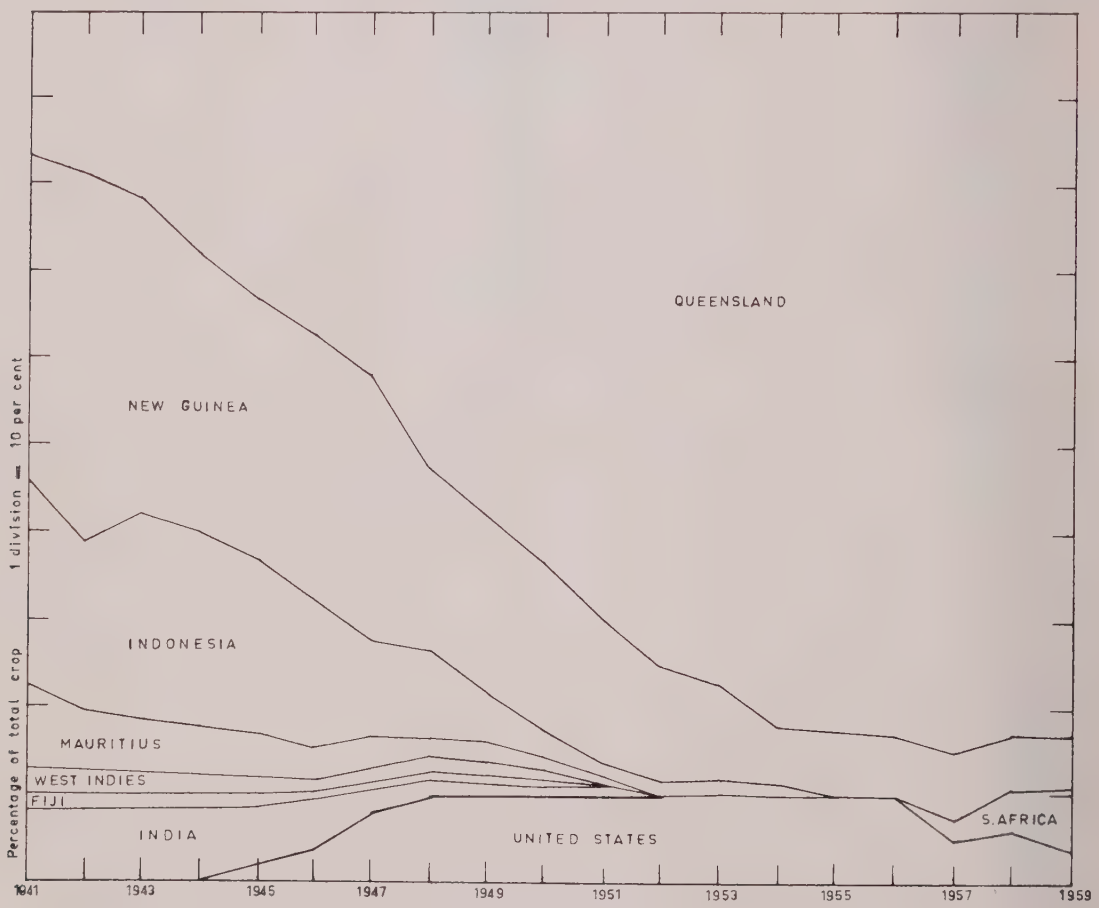
The large amount of cane again left standing in Mackay in 1959, which was of the order of 800,000 tons, and much of which was Q.50, left Pindar the undisputed leading variety in the state for 1959. It has well earned that position as it is the only variety which is grown in every mill area in the state. The 1,800,000 tons of Pindar harvested constituted 22 per cent. of the total crop, a figure only slightly less than its representation in 1958. Q.50, which ranked second in importance, with one and a half million tons harvested, dropped to 18 per cent. of the total crop and it is now evident that this variety on certain soil types is being rapidly replaced by Q.58 and Q.63.



H32-6774 a semi-wild Hawaiian variety which shows great resistance to lodging and may be a useful parent.

Trojan, still third-ranking variety, again yielded in excess of one million tons but three-quarters of this figure was produced in the Burdekin district, whilst north of Townsville it has lost much of its former popularity. These three varieties have occupied the three major positions, but in varying order, since 1952, a period of eight years, but they now have some strong rivals amongst the newer canes. No less than three of these in 1959 displaced the former fourth and fifth position holders, Badila and C.P.29-116. Q.58, Q.57 and N.Co.310 in that order displaced Badila and C.P.29-116 to seventh and eighth position respectively. All three of these new varieties have obviously not yet attained their peak. Q.58 is being planted on an even wider scale in the Ingham district and it also has possibilities in the far north, in addition to the fact that it does not yet appear to have reached its peak in the Central district. Q.57, although it has suffered some recession in the Burdekin district, has become very popular in Babinda, producing 50 per cent. of the crop there, and will undoubtedly occupy a considerable portion of the Innisfail and Ingham mill areas now that it is released for growing in those districts. N.Co.310, which in recent years has been so successful in the south as an early cane, is now becoming favoured for the same purpose in the Central district, so much so that its harvest there exceeded 100,000 tons in 1959.

Q.63, in advancing from twentieth place in 1958 to ninth in 1959, is also in a position to challenge Badila and C.P.29-116, as its high



Composition of the Queensland crop on the basis of the country of origin.

Keeping the crossing register and seedling records up-to-date is an important part of the breeding programme.

sugar content has ensured it an important place in the varietal programme of the Central district for some years to come. The next two varieties Q.59 and Vidar, ranking tenth and eleventh respectively seem less likely to extend much as they are more suited to specific conditions and in fact both occupied a similar ranking in 1958.

Other varieties which have made important advances are Q.70, which improved from thirtieth place in 1958 to seventeenth in 1959, Q.68 which moved rapidly from thirty-fourth to eighteenth and Q.66 which from twenty-fifth position moved on to nineteenth. The former is a southern variety, Q.68 is a Mackay selection whilst Q.66 is the rich land variety of the far north and the three are each expected to produce in excess of 100,000 tons within the next two years. Q.64 has also moved up the scale with 22,800 tons harvested in 1959 whilst Q.67 with 16,700 tons, Cadmus with 9,400 tons and Co.475 with 4,500 tons are new introductions to the harvesting list.

Co.290 and E.K.28 have now disappeared from the crushing records whilst Q.45 and Q.49 occupy the two lowest positions and appear destined soon to go.

Queensland-Bred Canes

The percentage of the total tonnage harvested represented by Queensland-bred varieties was, at 82.8 per cent., approximately the same as in 1958. The status of importations was maintained largely by N.Co.310 which, from 4.7 per cent. of the 1958 crop, advanced to 7.3 per cent. of the 1959 crop. This helped to make up for the fall in percentage of C.P.29-116 harvested, from 5.9 to 3.6, and this variety is now well on the downgrade. Its production has fallen to some 300,000 tons whereas, as recently as 1956, its harvested crop exceeded one million tons. Badila, also, although its percentage of the state crop only fell by 0.3 per cent., was represented by 100,000 less tons in 1959 and it is slowly but steadily passing down the pathway to oblivion. Only two other foreign varieties are represented on the approved list, P.O.J.2878 and Co.475, and whilst P.O.J.2878 is gradually passing into the discard, Co.475 is a recent approval and has yet to make its mark. In fact it is doubtful whether Co.475 will ever become important since

A vigorous New Guinea robustum in full flower at Meringa (57NG208).

it will only be grown on poor lands in the far north. Thus, of the five imported cane varieties still grown in Queensland only N.Co.310 has prospects of retaining its position as a major variety in the state economy.

It is interesting to note that South Africa has now displaced both New Guinea and the United States in order of importance as the origin of the imported varieties grown in Queensland. However, this South African variety, N.Co.310, has achieved major successes elsewhere as it is now the most important variety in Taiwan and is rapidly becoming popular in the United States. This, in spite of the fact that in its original country it is being displaced by other varieties.

New Varieties

Five new varieties were approved for planting during 1960. Q.69 and Q.72, formerly H.25 and H.46, are both drought-resistant types and were released for the Isis district. Q.71, formerly L.77, has an exceptionally high early sugar content and was released for Maryborough and Moreton districts. Q.73, formerly I.106, a variety capable of a good yield on a range of soil types but particularly suited to the better but not over-rich soils of the Central district, was ap-

TABLE VII.
Countries of Origin: 1959 Crop

Country of Origin	Tons of Cane	Per Cent.
Queensland ..	6,961,542	82.6
South Africa ..	615,976	7.3
New Guinea ..	527,686	6.2
United States ..	304,642	3.6
Indonesia ..	13,384	0.2
India	4,501	0.1
	8,427,731	100.0

An advanced Meringa seedling (54N7103) showing good growth characteristics.

proved for growing in Mackay and Proserpine mill areas. The fifth variety to be released is Damon, bred at Macknade by the Colonial Sugar Refining Company, and formerly known as 39M.Q.841. It is now approved for Macknade and Victoria mill areas. All these varieties are likely to be useful although none is expected to attain the great popularity of such recent releases as Q.58 and Q.63.

Varieties for which a wider range of approval was granted for the 1960 planting are Q.59, which was approved for Goondi district, Q.67 approved for Mulgrave and Babinda and Q.70 for which approval was extended to Maryborough.

It does not seem likely that approval for many new varieties will be sought during the coming year. At the present time two likely contenders are N.685, of the parentage H.35-198 x H.39-3633, and 54N6441, which derives from Co.475 x P.O.J.2878. Both were bred at the Northern Experiment Station and the former was selected from seedlings raised from seed received from Hawaii.

Table VIII
1959 Season
Varietal Composition and Distribution in the Four Main Districts and in the State as a Whole—1959 Crop

Variety	North of Townsville		Burdekin and Giru		Proserpine and Mackay		Bundaberg and South		Whole State	
	Tons	%	Tons	%	Tons	%	Tons	%	Tons	%
1 Pindar	1,521,620	43.0	107,393	9.5	77,106	3.7	137,813	8.2	1,843,932	21.9
2 Q.50	145,027	4.1	16,973	1.5	986,054	47.3	374,628	22.4	1,522,682	18.1
3 Trojan	312,980	8.8	854,393	75.6	17,197	0.8	1,445	—	1,186,015	14.1
4 Q.58	7,457	0.2	210	—	664,152	31.9	18,077	1.1	689,896	8.2
5 Q.57	525,276	14.8	75,616	6.7	25,783	1.2	—	—	626,675	7.4
6 N.Co.310	—	—	—	—	106,170	5.1	509,806	30.4	615,976	7.3
7 Badila	499,224	14.1	27,450	2.4	1,012	—	—	—	527,686	6.2
8 C.P.29/116	—	—	—	—	7,569	0.4	297.073	17.7	304,642	3.6
9 Q.63	—	—	—	—	118,054	5.7	15	—	118,069	1.4
10 Q.59	117,844	3.3	—	—	—	—	—	—	117,844	1.4
11 Vidar	114,216	3.2	—	—	—	—	—	—	114,216	1.3
12 Q.61	—	—	—	—	—	—	93,851	5.6	93,851	1.1
13 Q.44	87,952	2.5	—	—	—	—	—	—	87,952	1.0
14 Vesta	—	—	—	—	—	—	67,578	4.1	67,578	0.8
15 Q.47	—	—	—	—	—	—	67,339	4.0	67,339	0.8
16 Q.55	—	—	—	—	—	—	42,700	2.6	42,700	0.5
17 Q.70	—	—	—	—	—	—	38,992	2.3	38,992	0.5
18 Q.68	—	—	—	—	33,393	1.6	—	—	33,393	0.4
19 Q.66	31,323	0.9	—	—	—	—	—	—	31,323	0.4
20 S.J.16	—	—	26,041	2.3	—	—	—	—	26,041	0.3
21 Ragnar	24,906	0.7	—	—	—	—	—	—	24,906	0.3
22 Q.64	22,881	0.7	—	—	—	—	—	—	22,881	0.3
23 Eros	22,817	0.6	—	—	—	—	—	—	22,817	0.3
24 Comus	15,872	0.5	2,097	0.2	3,936	0.2	—	—	21,905	0.3
25 Q.67	—	—	16,496	1.5	285	—	—	—	16,781	0.2
26 Luna	16,588	0.5	—	—	—	—	—	—	16,588	0.2
27 S.J.4	16,414	0.5	—	—	—	—	—	—	16,414	0.2
28 Q.28	—	—	—	—	9,949	0.5	5,297	0.3	15,246	0.2
29 Q.65	—	—	—	—	14,029	0.7	—	—	14,029	0.2
30 P.O.J.2878	169	—	—	—	4,837	0.2	8,378	0.5	13,384	0.1
31 Cadmus	9.439	0.3	—	—	—	—	—	—	9,439	0.1
32 Castor	9,303	0.3	—	—	—	—	—	—	9,303	0.1
33 Sirius	7,818	0.2	—	—	—	—	—	—	7,818	0.1
34 Cato	7,548	0.2	—	—	—	—	—	—	7,548	0.1
35 H.Q.426	5,759	—	492	—	—	—	—	—	6,251	
36 Q.56	—	—	—	—	5,140	0.2	—	—	5,140	
37 Q.51	—	—	—	—	—	—	4,860	0.3	4,860	
38 Co.475	4,501	—	—	—	—	—	—	—	4,501	0.6
39 Q.49	—	—	—	—	—	—	2,108	0.1	2,108	
40 Q.45	—	—	—	—	2,038	—	—	—	2,038	
41 Others	12,264	0.6	2,248	0.3	6,988	0.5	5,472	0.4	26,972	
	3,539,198	42.0	1,129,409	13.4	2,083,692	24.7	1,675,432	19.9	8,427,731	100.0

Wallaby damage at Giru. Stools in foreground have been completely destroyed.

Division of Entomology and Pathology

R. W. Mungomery, Assistant to Director

Like the preceding year, the 1959-60 season was one of considerable over-production within the Queensland sugar industry. This unfortunate circumstance indirectly influenced in varying degrees the incidence of pests and diseases associated with the cane crop, while it also was the means of partially obscuring some of the results that were coming to light from the investigational work carried out within this Division.

Because of the anticipated over-production and a consequential desire to cut costs, a small minority of growers decided against making the usual application of BHC as a preventive against grub attack, preferring to accept the risk that their crops might not become infested. In many instances this risk was not justified and grub damage developed in widely scattered centres such as Carmila, Mackay, Ayr, Innisfail and Mulgrave districts. On a few individual farms the damage was so serious that doubts were raised as to whether the quota of cane allotted for harvest on these farms would be realized. Crop restrictions tolerated in this manner can be of little avail if the growers concerned do not succeed in producing their allotted quotas, since their shortfalls merely re-act to the advantage of other growers who have been sufficiently far-seeing to adopt the appropriate measures against pests and diseases.

It is estimated that approximately 6,000 tons of cane were destroyed by grub attack, which represents a considerable rise above the all time low of last year. Nevertheless the impact of this on the crop as a whole was negligible.

Over the year there was a decided impetus given to the spray application of lindane to the soil as an alternative to the dust application of BHC for cane grub control. This resulted largely through one manufacturer fabricating a number

of spray units, which could be adapted to most tractors, and lending them to interested growers in an attempt to popularize his machines. In addition, a number of demonstrations were carried out in most of the districts from Ayr northwards. Over 1,200 acres were treated in the Burdekin district, and the expectations are that there will be a steady rise in popularity of this method of control as growers gain greater confidence in it. Already the entry of lindane into the sphere of cane grub control has been the cause of a considerable reduction in the price of BHC dusts.

In South Queensland the first stage of a trial against the Childers cane grub indicated that successful control was being obtained in the plant crop in plots where gamma BHC had been broadcast and ploughed under at rates of 4 and 8 lb. per acre before planting, but little is yet known regarding the number of succeeding ratoon crops over which these dressings will remain effective. This was the only one of several trials that became infested and it emphasises the difficulty of attempting to anticipate where severe infestations are likely to develop; furthermore it highlights the doubts regarding the economic practicability of this form of control in preference to control by cultural operations. Since many of previous trials involved the variety C.P.29/116, it also reflects the value of this grub-tolerant variety which has been the mainstay of production in the Isis district for many years. Since there is a tendency to swing over to higher sucrose-yielding varieties which are more susceptible to grub damage or whose reactions to grub attack are still not fully known, it could well be that grub damage in the southern districts is likely to assume greater importance in the years immediately ahead.

Over-production led to the termination of harvesting operations in a field in which a trial against the soldier fly was located and only two replicates of the trial were cut, the remainder being stood over. The subsequent ratoons from these two replicates showed damage of varying intensity, and the limited results indicated that BHC at rates of 4 and 8 lb. gamma isomer per acre broadcast and grubbed into the surface soil in May, 1958, round about the time of emergence and egg-laying, had effected a good control up to the first ratoon crop. This successful break-through against the pest has stimulated further investigations with BHC and lindane, involving different rates and times of application, placement of the insecticides in the soil and the duration of their effective residual properties. An answer to the control of this pest seems now to be in sight.

The increase in the sugar cane scale, particularly in South Queensland, because of the greater proportion of standover cane and the drier conditions there, again focused attention on ways and means of dealing with this pest. Since these insects may be wind borne in the crawler stage, there appears to be no more

Rind disease and scale insect combine to attack a crop of standover Q.70 at Childers.

logical and practicable method of restricting their spread than by the use of resistant varieties. This aspect will be given due prominence as the new project of developing varieties specifically suited to the drier, hilly areas of the Isis and Gin Gin districts, gets under way.

Hitherto many growers relied on dogs, notably beagle hounds, to drive wallabies away from their cane crops during the dry spring months and generally they performed an excellent service. However these dogs had the unfortunate characteristic of wandering, and this habit often led them to trespass on nearby cattle properties and disturb stock there, which often resulted in bad feeling between neighbours. For that reason investigations into alternative methods of dealing with the wallaby pest were commenced, and the discovery that blood and bone fertilizer is an effective deterrent against the sandy wallaby was a welcome outcome of this work.

Ever since the greyback grub has been under adequate control, the rat pest has continued to inflict the greatest amount of damage to mature cane each year, and although losses were not unduly serious over the past year, they were nevertheless substantial and were no doubt minimized by virtue of the fact that some of the worst attacked crops were included amongst those which were destroyed because they were in excess of farm quotas. This pest offers ample scope for additional investigations, particularly in the biology of the smaller khaki climbing rat and the efficacy of some of the newer compounds which, whether rightly or wrongly, are being publicized as promising rodenticides.

A new development in baiting has been the adoption of the thallium wheat bait which is now machine packeted in glassine; the "take" of these glassine wrapped baits has been highly satisfactory.

A joint project involving the trapping of aphids to determine what species are present in the tropical and sub-tropical cane areas and their seasonal movement was commenced with Dr. V. F. Eastop of the British Museum early in 1960. Since his departure from Australia this work has been continued with the Division of Entomology, Commonwealth Scientific and Industrial Research Organization. Catches in late summer and autumn were small and after some preliminary studies to determine the most pro-

Scale insect on Pindar at Giru.

ductive trapping sites, the investigations settled down to a fixed routine. The Sugar Experiment Stations at Gordonvale, Brandon, Mackay and Bundaberg are co-operating in this scheme, and although there has been a large increase in the number of aphids intercepted during the winter months, eighteen species having so far been involved, it is too early yet to detect any distinct trend in their seasonal flights. These studies are being continued and it is hoped to use the results as a basis for further work on the transmission and control of certain sugar cane diseases.

There was a slight deterioration in the disease position throughout the State, but happily this decline was detected in its early stages, thereby enabling corrective measures to be instituted before any serious losses could occur. Perhaps the most insidious of the diseases involved is ratoon stunting disease which staged a consistent comeback in many areas. This was mainly because over-production influenced numbers of growers not to purchase new stocks of clean planting material while their own stocks remained apparently healthy. However conditions during the year proved almost ideal for the development of internal symptoms and many of the fields which had hitherto been considered clean were subsequently found to be infected. Q.67 in the Burdekin, Q.58 in the central districts and Q.71 in some of the southern areas were cases in point. In consequence, a more intensive hot water treatment campaign has been advocated, and all districts have been asked to co-operate during the coming spring period by strongly pushing the policy of regularly infusing clean stocks into the planting programme. In most districts there are usually one or more varieties which seem to highlight the presence of disease, and if these can come to be regarded as indicators and regularly inspected, the position is never likely to get seriously out of hand.

Chlorotic streak disease was found for the first time on farms bordering both sides of the Burdekin River, but since it had previously been seen in the nearby Giru district, its occurrence on the Burdekin was not altogether surprising. As usual it was found on farms subject to flooding. Quarantines imposed on the affected farms may not restrict spread seawards, but they should slow up the spread of this disease in other directions. Its impact on the comparatively dry Burdekin area is not likely to prove serious.

Undoubtedly the most unexpected recurrences of disease were the outbreaks of leaf scald in Q.63 at Proserpine, Mackay and Bundaberg, while in Bundaberg infection was also found in Q.71 as a result of knife contamination from nearby diseased Q.63. It is known that leaf scald was present in the Mackay district in the 1930's, but failure to find it after the war years led to the belief that it had disappeared from that area. However the most likely explanation is that it lingered on undetected in the susceptible Clark's Seedling, E.K.28 or S.J.2, which continued on the list of approved varieties, and one or other of these was probably the source of infection for Q.63. Fortunately the more popular varieties in the central and southern areas are resistant to this disease, so this barrier of resistant canes, plus the destruction of diseased blocks, should go a long way towards containing the disease and ultimately eradicating it from those centres.

As a result of the Mackay and Bundaberg outbreaks, it became necessary to make provision against the planting and removal of leaf-scald affected cane, so matters were set in train to cancel the existing quarantine proclamations and in their stead gazette new proclamations incorporating these points.

Further north in the wetter areas, where leaf scald is endemic and where a number of susceptible varieties are being grown, an attempt is being made to keep the highly susceptible but otherwise valuable anti-lodging Q.66 reasonably clean while other resistant, similar-purpose canes are being developed. Emphasis is being laid on the desirability of obtaining planting material from healthy fields, but where this is not possible permission is being given to take planting material from lightly infected fields

Seedling plots need to be carefully inspected for disease.

from which all known diseased stools have been rogued. Whether this latter procedure will allow the status quo to be maintained is a moot point and will depend largely on the efficiency of the inspections and the extent to which the disease may remain masked within this variety. With these limitations in mind, the outcome of this approach to the leaf scald problem in relationship to these special purpose canes is being carefully watched. However, in view of the fact that some of the varieties which at present are being grown fairly extensively may mask their symptoms for long periods and may in fact be acting as unknown carriers of this disease, the overall position in respect of leaf scald is not likely to deteriorate suddenly. On the other hand, there can be no hope for any marked improvement while any large percentage of susceptible varieties continues to be grown.

The re-appearance of dwarf disease in the Mackay district, this time in the variety Q.68, was somewhat disquieting since this variety appears to be rather tolerant, and some plantings from diseased stocks were unwittingly made before the outbreak was discovered. Here again the destruction of diseased fields and the quarantining of diseased farms should soon result in a substantial improvement.

There was an upsurge of mosaic, too, on a number of farms in the Booyal area where the indistinct mottling of the affected Q.50 was undoubtedly a factor in the unintentional planting of diseased cane in a few instances. Although the destruction of badly diseased blocks and the roguing of lightly diseased fields will greatly lessen the incidence of this disease, its control will be complicated by the presence nearby of diseased wild sorghum, which is carrying large populations of the aphid vector.

On the credit side, Fiji disease was not seen in crops produced for milling purposes, so even if it has not entirely disappeared from Queensland, Fiji disease is now at its lowest ebb since control operations were instituted approximately 35 years ago. It is realized that infection could still exist in some of the fodder canes growing in the adjacent dairying districts of Southern Queensland and that infection might readily spread from any such remaining foci back into the commercial crops. In an effort to circumvent such a happening, close liaison is being maintained with the advisory field staff of the

Queensland Department of Agriculture and Stock, and it is anticipated that they will fulfil their part by recommending the use of clean stocks of resistant varieties and ensuring that diseased stools are destroyed wherever they are detected.

It is not known whether the discovery of the various outbreaks of disease previously referred to came as a direct result of refresher courses on pests and diseases, which were held in November, 1959, and March, 1960, for Supervisors of Cane Pest and Disease Control Boards and their assistants and for junior members of the Bureau's field staff; however the courses were the means of inculcating in those attending a greater awareness of pests and diseases and the means of combating them, so to that extent they may have had considerable influence on the detection of these more recent outbreaks. Some of the highlights were the visits to the Pathology Farm where all were afforded an opportunity to gain first hand experience with most of the serious diseases that have been troublesome in Queensland over the years, and as a result, the inspectional staff are now better equipped to carry out the duties required of them in their different centres.

The Annual Conference of Cane Pest and Disease Control Boards, which was held at Ingham on 27th April, 1960, again attracted a large gathering of 53 representatives from all 21 Boards while 12 Bureau officers also attended in an advisory capacity. On the pest side grubs, soldier fly, and wallabies were dealt with, while papers on mosaic, chlorotic streak, eye spot and hot water treatment against ratoon stunting covered the disease angle.

A good control of wallaby damage using blood and bone. Treated row on left.

A demonstration of lindane spray application for grub control.

Entomological Investigations

G. Wilson, Senior Entomologist

The Greyback Cane Beetle, Dermolepida albohirtum Waterh.

In December and January beetles emerged in very large numbers in the Lower Burdekin, completely defoliating feeding trees over an area extending from Home Hill to the extremity of the Up River cane area. In the Ingham district beetles were much more numerous than has been the case in recent years. At Mackay, flights commenced on 28th November. Beetles emerged during December between Meerawa and Quingilli, and at Upper Mulgrave, in the Mulgrave mill area, and at Kamerunga in the Hambledon area. Moderate to severe grub damage developed in a number of fields on which BHC had not been applied, and in a few instances where BHC distributors had not functioned properly. In far northern districts, the infestations were mainly on the periphery of cane areas, in proximity to natural vegetation which harboured local populations, but the sudden increase in the number of fields so affected demonstrated that the pest is still capable of the dramatic fluctuations that characterised its behaviour when, prior to the use of BHC, the small amount of soil fumigation practised left it virtually uncontrolled. The lesson is obvious; if the downward trend in the use of BHC continues, these local populations could expand, with serious consequences. In Central Queensland mill areas the infestations were not necessarily peripheral, but reflected the fact that the restricted use of BHC, arising from the sporadic nature of infestation in these areas, must continue to result in grub damage.

The loss recorded amounted to 5,400 tons of cane on 1,435 affected acres. While that loss is much greater than the very low figures of 468 and 920 tons loss recorded in 1958 and 1959 respectively, it compares favourably with the

Greyback grub damage at Sawmill Pocket, near Cairns.

22,000 tons lost in 1957; and whereas of the latter over 16,000 tons was recorded in the Burdekin district, the 1960 damage has been more evenly distributed, no district suffering a major set-back.

Other Species of Cane Grubs

Frenchi beetles, *Lepidiota frenchi Blkb.*, commenced flying at Mackay on 28th November, and during December in the Mulgrave and Hambledon areas where they were numerous between Gordonvale and Fishery Creek, and at Jungara. Since the species has a two-year life cycle, grubs which affected the 1960 crop were the progeny of emergences in 1958; they reduced cane yield by an aggregate of 334 tons on 43 affected acres, this being contributed to substantially by growers who persisted in the long-discredited practice of ploughing and re-planting immediately after the harvest of the preceding crop. The damage thus incurred could have been greatly reduced, perhaps entirely eliminated, by the application of BHC at planting time instead of several weeks after planting as is customary against the greyback grub. It is noteworthy that Mackay, where the pest was serious in some past years, escaped any damage worth recording, for the seventh year in succession.

At Hambledon, another species with a two-year life cycle, *Lepidiota consobrina* Gir., caused the loss of 60 tons of cane on 12 acres. However, as an index of the sporadic nature of grub infestation and its effect on experimental work, it is recorded that only negligible infestation by that species has been experienced in two successive years in a BHC trial adjacent to a field

on which cane was completely destroyed three years ago.

"Mossman" grubs, with a one-year life cycle, damaged 36 acres of cane at Mossman, causing a crop reduction of 180 tons. These grubs were observed in moderate numbers at Smithfield in the Hambledon area but no damage to cane was recorded there. These grubs have not been morphologically distinguished from *L. consobrina* to date, but the distinction between a one-year and a two-year life cycle is important from the agricultural standpoint, so the common name of "Mossman" grubs is retained for the one-year form. Similar grubs collected at Mango Park, Mossman, in May, 1959, exhibited instar periods which do not accord with either the one-year or two-year cycle as known with respect to other species, and further investigation is required. In the Yule Point-Port Douglas sector at Mossman mixed infestations of "Mossman" grubs and the recently identified *Lepidiota wilsoni* Britton and *Lepidiota grisea* Britton render it difficult to allocate the specific responsibility for damage to cane, but the damage caused by *L. wilsoni* has been assessed at 70 tons of cane on seven affected acres; the pest status of *L. grisea* is uncertain. At Bambaroo, near Ingham, adults of *L. wilsoni* emerged in October from irrigated land, and during November from very dry soil. Grubs collected under damaged cane, at Bambaroo, closely resembled those of *L. grisea* and were bred out to adults also resembling that species, but with minor characters which suggested that they are of another species. Grubs found under damaged cane at Coonarr Creek, Bundaberg, were presumed to be *Rhopaea mussoni,* but are being bred out for positive identification; at Didillibah, in the Moreton mill area, grubs of *Rhopaea* sp. were found where cane had been damaged. The Bundaberg grub, *Lepidiota trichosterna* Lea, and the Childers grub, *Pseudoholophylla furfuracea* Burm., caused sporadic damage in their respective districts.

Insecticides for Grub Control

The 37,356 acres on which BHC was applied for grub control in the 1960 crop was 7,755 less than the 45,111 acres treated in 1959 — a reduction of over 17 per cent. At South Johnstone the practice of retreating ratoons on a large scale (2,000 acres in 1959) suddenly ceased but plant crop applications increased by 580 acres; the most outstanding individual decreases were 1,674 at Victoria, 1,320 at Tully, and 1,074 at Invicta. The decline in the use of BHC can be attributed to the fact that growers must economise in the face of rising costs and restricted harvest quotas, and some have fallen into the error of assuming that the absence of serious grub damage in the previous two years justifies the omission of BHC. The risk inherent in any extension of this policy has been referred to above. Since excess cane was left on many farms, the grub damage herein recorded does not necessarily imply a reduced harvest by every individual grower concerned, but it would obviously be more economical to meet the impact of over-production by planting a lesser area and giving it the cheap protection afforded by BHC than to cultivate excess area and tolerate unpredictable grub damage.

The use of lindane sprayed in water, either as a wettable powder or in a suspension with the aid of a non-sudsing detergent originated in 1957 in the Lower Burdekin, the main advantage being that imported lindane costs only approximately half as much as the equivalent crude BHC dust. During 1959, the necessary spraying equipment with sufficient turbulence in the reservoir to keep the lindane in suspension became available commercially, and of the 6,000 acres treated with BHC in the Burdekin and Invicta districts, 1,215 were treated with lindane. The method was not used to any appreciable extent in other districts, perhaps because demonstrations of the equipment were made when the seasonal use of BHC was virtually over. Field observations during two years have not disclosed any break-down in the protection by lindane, but the rates of application have generally been somewhat in excess of the amount strictly required to give two-year protection.

Experiments with Insecticides

In laboratory tests, 99.9 per cent. lindane, a 50 per cent. micronized lindane wettable powder, and 20 per cent. crude BHC dust mixed with soil in concentrations of 4, 8, and 16 parts of active ingredient per million, were equally effective against cane grubs both in speed of action and final mortality. These tests were completed under laboratory conditions within a few weeks of the insecticides being mixed with the soil. One aspect that was not resolved was whether the different particle sizes, or the extraction of the lindane from the inactive isomers, will affect the persistence of lindane in the soil, an important aspect of the economy of grub control in Queensland where a single dressing gives three years of protection. Field trials with lindane and crude BHC dust designed to supply that information have not suffered sufficient grub infestation to give results. To obviate that impediment to progress, concrete enclosures are being constructed in which insecticides mixed with soil can be exposed to the elements and the effects of cane growth, and the residual efficacy of the insecticide determined by bio-assay at suitable interrvals of time. In pot tests 20 per cent. crude BHC dust, 50 per cent. micronized lindane wettable powder aldrin, dieldrin, and heptachlor were screened at 4, 8, and 16 parts of active ingredient per million of air-dry soil, against greyback grubs. During the first week lindane and crude BHC acted more rapidly than the other insecticides, but complete mortality of grubs was obtained in all the insecticides at all concentrations in four weeks. In a similar test against Childers grubs mortality progressed more slowly and was not complete with the lowest concentration of lindane until the tenth week, at which time there was still 15 per cent. survival in the lowest concentration of crude BHC. However the progressive comparisons between lindane and crude BHC in the interim period did not justify a deduction that crude BHC was in practice less effective than lindane. Aldrin, dieldrin, and heptachlor caused only slight mortality of Childers grubs as also did sevin and trithion which were used at only 16 p.p.m. .

In two field trials with BHC against "Mossman" grubs at Rocky Point in which negligible infestations were encountered in 1959, the average number of grubs found per stool in untreated control plots in 1960, was 7.0 in one trial and 7.2 in the other. However, for reasons which are not known these grubs did not cause any detectable symptoms of damage, and in one trial which was harvested, the yields from untreated and variously treated plots showed no significant difference. Quantitative BHC field trials against frenchi and consobrina grubs, which included a comparison between sprayed lindane and crude BHC dust, have not been sufficiently infested since their inception in 1958 to yield useful

An experimental set-up for investigation into the problem of frenchi grub control.

information. In a BHC trial against the Childers grub, in which 20 per cent. BHC was applied at rates of 150, 300 and 600 lb. per acre, broadcast before planting, these rates being either divided equally between an application ploughed in deeply and a second application disced in, or fully applied and ploughed in, results in the plant crop indicated that a minimum requirement for control was the deep ploughing in of not less than 150 lb. per acre, and still larger amounts might be required for complete control. This trial did not include any applications in the drill. The sporadic and uncertain occurrence of the Childers grub renders chemical control at such heavy rates a doubtful economic proposition, which even the lower priced lindane might not fully alleviate, and it could well be that the long-standing recommendation to destroy the larvae by suitable cultural practices before planting, may, together with the use of resistant varieties, remain the most practicable approach to the problem for some time to come.

In the long range investigation into whether BHC, crude or refined, at the rates generally used for grub control, may eventually affect soil fertility, the harvesting of a first ratoon crop at Babinda, and a second ratoon crop at Bundaberg supported the evidence of previous cropping cycles that no change in fertility has taken place.

With a view to setting out field trials against termites, particularly the giant termite, *Mastotermes darwiniensis* Frogg., which destroy germinating setts, and to exclude which a complete protective envelopment of the sett might be necessary, a preliminary phytotoxicity trial was set out in which lindane, aldrin and heptachlor as wettable powders were added at 0.25 per cent. concentration to a mercurial sett dip. As an alternative, or in addition, to the dip, lindane and aldrin were applied in the furrow at half-a-pound and at one pound per acre, and heptachlor at one pound per acre, the applications being divided into a three to four-inch wide band in the bottom of the furrow before the setts were laid, and a second band of similar width over the laid setts and adjacent soil. Aldrin and heptachlor had no important adverse effect on germination either as a soil spray or a dip or when both were combined, nor did lindane with respect to the soil spray, but the latter did cause erratic, adverse effects when used as a dip alone or with soil spray. The lowest mean germination obtained, where the lindane dip was combined with the one pound soil application, was 73 per cent. of that obtained from controls dipped in mercurial only.

The Funnel Ant, *Aphaenogaster pythia* Forel.

The funnel ant, which reduces yields, particularly through weak ratooning, over localized areas from Mossman to Ingham, was recorded also at Mackay in the Richmond sector of the Farleigh area, and at Giru. The related *A. longiceps* Sm. was recorded at Mutarnee near Ingham, but appears to be unimportant in cane since normal cultivation quickly depresses its colonies. At Bundaberg, funnel ant infestations were of minor extent; specimens from that district previously identified as *A. longiceps* have since been determined as being more closely related to *A. pythia* but are not typical of that species, the head being too narrow. In exploratory plots at Tully in 1958 aldrin at 20 lb. per acre, broadcast and ploughed in, completely prevented ant infestation in the plant and first ratoon crops; first ratoon cane on the treated plots is now distinctly superior to adjacent unprotected cane. Since the 20 lb. application also inhibited infestation for some distance downhill outside the treated plots, lower rates were used in a randomised trial set down at Meerawa in 1959. Aldrin at 5, 10, and 15 lb. per acre was applied by three methods viz. (1) entirely broadcast and ploughed in prior to planting, (2) divided equally into two broadcast applications one before and one after ploughing, the latter being subsequently disced in, and (3) entirely applied as a side dressing in the half-open drill five months after planting. In the plant crop untreated plots became heavily infested. Infestation was established before the half-open drill

application was made, nevertheless that treatment effected a marked reduction in the number of craters to be found. The single ploughed-in application completely prevented infestation where 10 or 15 lb. was applied, but permitted minor infestation in the 5 lb. rate. The divided broadcast application was slightly less efficaceous, minor infestation occurring at all rates. On infested areas at Tully the variety Pindar has been most frequently encountered in trial fields in past years. A recent change on one farm to Q.57, Q.64 and Vidar, with some Pindar available for a comparison, has shown that the three substituted varieties are much more susceptible than Pindar to damage by the ants, but as the varietal change was made because Pindar gave low sugar content, a reversion to that variety is improbable, and resistant varieties with a satisfactory sugar content are being sought among the new seedlings. In laboratory tests aldrin, trithion, sevin, A6306 and A6321 were screened, in concentrations of 1, 2 and 4 p.p.m. in air dry soil, against *A. pythia.* Aldrin caused 45, 90, and 90 per cent. mortality in the respective concentrations in a nine day period, while the other insecticides had only negligible effect.

Soldier Fly, Metoponia rubriceps Macquart

At Bundaberg and Childers soldier fly larvae may affect germination by feeding on the root band and eyes of setts; they are also a contributing factor in the poor ratooning problem there. Adults commenced emerging from the soil rather early in 1960, in March, and emergence continued until the end of May; larvae transferred to cages at Meringa gave rise to adults during April, and at the end of May. At Mackay, larvae affected germination on one farm during July and one adult emerged in the laboratory in the first week of August from larvae collected there. In a trial at Bundaberg in which gamma BHC at 2, 4, and 8 lb., aldrin at 4 lb., and dieldrin at 2.4 lb., per acre were broadcast and grubbed in late in May, 1958, and left undisturbed for four weeks before the field was planted, normal first ratoons were obtained where 4 or 8 lb. of gamma BHC had been applied, and no larvae were found in the soil, whereas the other treatments, and untreated controls, resulted in poor ratoons; two stools in untreated plots yielded 48 and 21 larvae and 51 were obtained under a stool in the aldrin-treated area. Similar dressings of BHC have failed to give any control where they were applied in July, August or September, or where an application made in April was disturbed within one week by planting operations.

Earth Pearls, Margarodidae

Life history studies are being continued with earth pearls. Although *Eumargarodes laingi* Jakubski has a one-year life cycle, individuals of another un-named species associated with sugar cane, may reach the adult stage in one year, while others require two or even more years to reach maturity. Cysts of the un-named species which were collected in 1956 and kept in glass tubes without soil or nutriment until 1959, resumed feeding and growth when placed close to cane roots. While the cysts lack mobility, if a root being used for food died the feeding tube could be transferred, it was found, to a new root growing in the vicinity. Some cysts maintained their tubes in roots continuously, while others withdrew the tube intermittently for periods of at least several days. No co-relation was detected between apparent feeding and growth. Only about half the cysts observed to feed increased in size, the increase in size being accompanied by a fracture of the cyst at the pole farthest from the feeding tube; whether that fracture coincides with a change of instar remains to be clarified. In a field trial at Qunaba, Bundaberg, in which aldrin and BHC had been applied to the soil, there was no apparent benefit from the use of either insecticide.

Miscellaneous Insect Pests

At Ingham unidentified caterpillars occurring in November caused no apparent damage, but

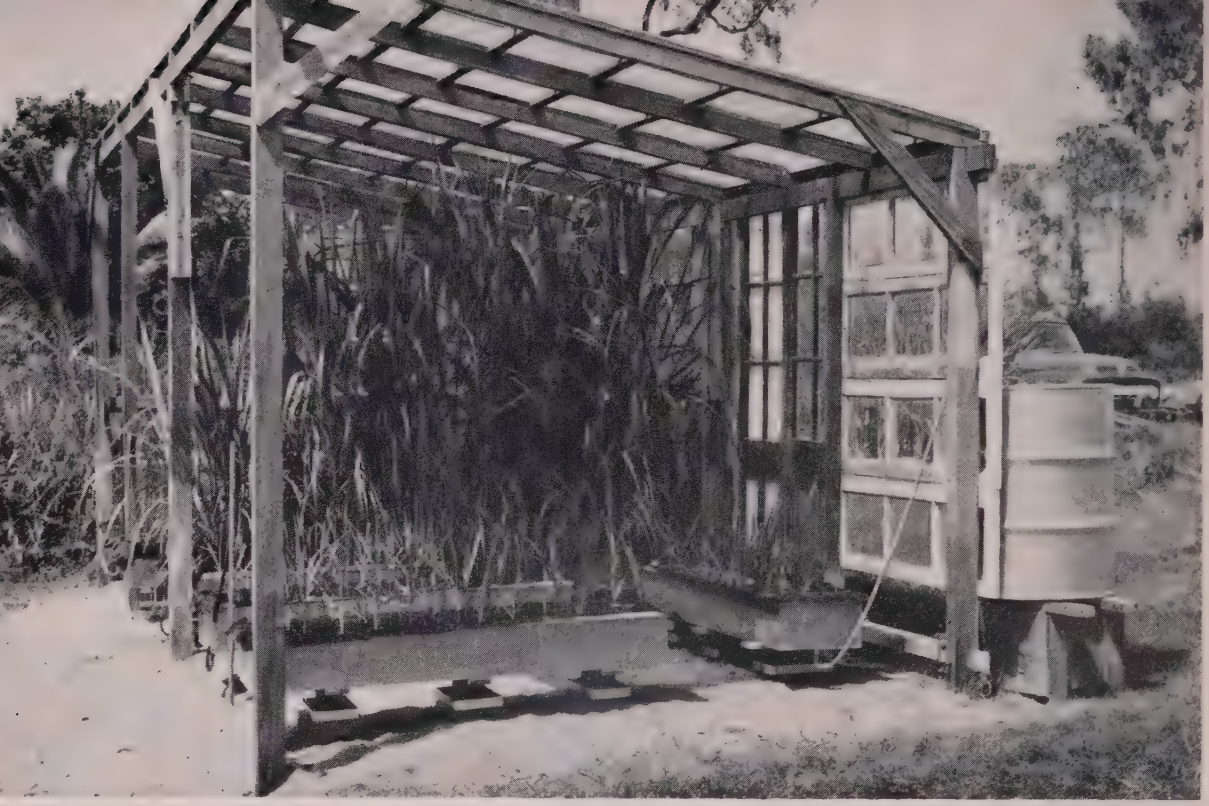
during January and February *Laphygma exempta* Wlk. reduced the yield on 144 acres by about 172 tons, and minor outbreaks of *Mocis frugalis* occurred during March. Caterpillars were of widespread occurrence at Giru in November and February, and at Proserpine infestations were associated with weedy cane, but no appreciable damage was recorded. December infestations at Behana and Little Mulgrave in the Mulgrave area caused little damage. Beetles of *Rhyparida morosa* Jac. were bred from larvae damaging cane near Bingera, Bundaberg, in December, while larvae of a species of *Rhyparida* attacking cane in Proserpine in December were not successfully bred to the adult stage. Larvae of *Chauliognathus nigroterminalis* obtained in the vicinity of poor ratoons in December at Sarina pupated late in December, adults emerging between 30th December and 4th January. So far no evidence has been obtained to implicate the larvae in any damage to cane roots. The grey mealy bug, *Dysmicoccus boninsis* Kuw., not frequently seen on cane, was observed on cane at Meringa. The pink mealy bug, *Saccharicoccus sacchari* Ckll., prevalent in all cane areas, was found to be fairly heavily parasitised in all cane districts by *Anagyrus saccharicola* Timb., and also preyed on by the larvae of an unidentified Drosophilid fly. Wireworms, *Lacon variabilis Cand.*, and minor unidentified species occurred to a limited extent at Innisfail, Hambledon, Giru, Proserpine and Mackay, but where they were likely to be of importance, light dressings of BHC applied in fertilizer at planting time kept them in check. The giant termite, *Mastotermes darwininesis* Frogg., did minor damage in the Burdekin area, destroying 60 tons of cane on 35 acres. The black beetle, *Metanastes vulgivagus* Oliff., occurred at Mulgrave on a few acres, and on 20 acres at Goondi, but was prevalent at Mourilyan, where lindane at the rate of 0.26 lb. per acre, applied in the fertilizer used at planting time failed to give control. Another Dynastid, *Dipelicus optatus* Sharp, ate the sett roots and occasionally gnawed into the primary shoots of young plant cane in a deep coarse sand bordering on Bell's Beach at Mossman, during June, 1959, and again in June, 1960. One larva collected in April pupated early in May; the adult emerged during July. In late July larvae ranged from medium second instar to advanced third instar, and matured adults were present in August. This autumnal activity is in contrast to the spring and early summer peak of activity of *M. vulgivagus*. Chemical control has not been attempted yet, but its mode of attack suggests the use of BHC at planting time.

Animal and Bird Pests

In 1959, rat damage to cane was scarcely noticeable until July, when there was a sharp increase but subsequent damage during the harvesting season was not as great as is frequently experienced; the effect on the crop was estimated at a reduction of 21,000 tons. Rat attack commenced much earlier in 1960, in April. Several Cane Pest and Disease Control Boards laid poison bait on pilot areas in that month, before recommending widespread poisoning by growers, and the take of bait was in most instances sufficient to warrant baiting on a larger scale. Field men in almost all districts expect rat damage in the 1960 crop to be appreciably greater than in that of 1959, but Innisfail observers have not detected signs of increasing infestation. In mid-1959 the packeting of thallium-coated wheat bait by hand virtually ceased; machine packeting in paper coated internally with polythene became universal except for a minority of districts which considered that the new form of packet was less readily taken by rats. However, carefully conducted tests showed that the new pack was as acceptable as the old. In mid-1960 the polythene-coated paper was discarded in favour of a special type of imported glassine which field tests had shown to be much more readily taken by rats than either of the preceding packs. Experiments in the Mulgrave area showed that if polythene-coated or glassine packets were lightly sprayed with raw linseed oil, there was a

greater take than of unsprayed baits, in fields where *R. conatus* and *M. littoralis* were found by trapping.

Wallabies damaged young cane during the dry spring on 80 acres at Mossman, 40 acres at Proserpine and 100 acres at Mackay, with varying effects on the crop difficult to assess, but on the Ayr side of the Burdekin district they invaded cane in large numbers and by persistent feeding caused an estimated loss of 2,150 tons of cane. At Inkerman no serious loss was reported, but hunters accounted for 1,923 of the animals. At Ayr it was found that wallabies ceased feeding, or were prevented from feeding, where blood and bone, or blood meal fertilizer was sprinkled along the rows at about 112 lb. per acre. Damage by wild pigs was estimated at several hundreds of tons in the Mossman area, but elsewhere they were of minor importance; wire-netting fences have been extended in recent years with much success. Where broken topography made fencing uneconomic, poison baits were tried but without success. The striped phalanger, *Dactylopsila picata* Thomas, scooped out the tissue of mature cane stalks in fields adjoining its forest habitat, from Mossman to Tully and at Mackay, causing small losses on individual farms. Of the bird pests the bald coot, *Porphyrio melanotis* Temm., was most prevalent; at Ayr its feeding reduced the crop on 30 acres by 150 tons, and 60 acres were affected less severely at Proserpine. In the latter area the white cockatoo, *Kakatoe galerita* Lath., was less troublesome than in recent years. At South Johnstone the shining starling, *Aplonis metallica* Temm., by roosting in large numbers broke down cane foliage, with some resultant loss of cane growth.



A chlorotic streak experiment with cane growing in gravel culture in a shelter house.

Disease Investigations

C. G. Hughes, Senior Pathologist

Chlorotic Streak (Causal agent unknown)

Investigations into chlorotic streak disease during the year July, 1959, to June, 1960, included field observations and trials and bench studies.

Routine field inspections revealed for the first time the presence of the disease on the Lower Burdekin. This important irrigated district, as the last remaining area where the disease had not been recorded, had been under particularly close surveillance for some years and had the disease been present there before it must have occurred in very small amounts or very sporadically. The findings this year involved three farms on the Inkerman side of the River and one on the other. In each instance, the disease occurred in badly drained, heavy soil, liable to flooding.

The first ratoon crop of a yield trial in typical chlorotic streak country at North Eton, Mackay, gave satisfactory yields for trial purposes, but the spread of disease into the originally healthy plots had obviously reduced the differences. Results for both plant and ratoon crops are shown in the accompanying Table. Tonnage differences for Pindar and Q.50 were significant at the one per cent. level in the plant but only at the five in the ratoons; for Q.58 there was a difference significant at the five per cent. level in the plant crop but none in the ratoons and differences for C.P.29/116 were not significant in either crop. Differences were not significant for sugar content in any variety in either crop. The customary particular care was taken in the selection of plants to avoid contamination with ratoon stunting and the differences are considered to be due to the effect of chlorotic streak alone.

Chlorotic streak yield trial results, tons cane per acre

North Eton Trial	C.P.29/116		Q.50		Q.58		Pindar	
Crop	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon
Healthy	41.3	37.1	38.2	28.6	37.8	30.0	35.0	29.2
Diseased ..	34.6	35.9	30.4	22.6	26.7	32.4	22.4	23.8
Difference ..	N.S.	N.S.	**	*	*	N.S.	**	*

Dumbleton Trial	N.Co.310	Q.50	Q.56	Q.63
Crop	Plant	Plant	Plant	Plant
Healthy	32.3	30.5	27.8	28.7
Diseased ..	28.2	26.1	23.0	22.8
Difference ..	N.S.	**	**	**

N.S.: not significant. **significant at 1% level. *significant at 5% level.

A trial at Dumbleton, also in the Mackay district, included N.Co.310, Q.50, Q.56 and Q.63, and was harvested in the plant crop in September, 1959. Results shown in the Table indicate a serious loss due to the disease in the varieties Q.50, Q.56 and Q.63. The small differences in sugar content of the diseased and healthy series gave no indication of significance.

Another yield loss trial using the variety Q.66 from two separate sources was also harvested in the spring of 1959. It was at Mt. Sophia in the very wet belt in North Queensland and showed a significant decrease due to the disease in both lots of plants. Averaged figures were : healthy 34.6 tons per acre, diseased 30.0. Again there were no differences in c.c.s. figures.

Original seedlings of the crosses Trojan x Q.28 and Trojan x Q.58, (which parents are all susceptible to chlorotic streak disease), inoculated in the potted stage by rubbing the leaves with a fresh extract from diseased leaves mixed with kieselguhr, did not show any disease in the plant crop. In the ratoons, disease developed throughout the planting but the numbers occurring in the inoculated series were not significantly different from those in the controls.

Plantings designed to find whether hot-water treatment or surface sterilization of setts (with mercuric chloride) had any effect on subsequent development of the disease, were set out in several districts. Varieties used included N.Co.310, Pindar and Q.67. Results indicated there was no effect.

An experiment at Meringa in which diseased and healthy shoots of the varieties Pindar and Q.67 were grown in the same drums was designed to examine the possible effects on transmission (1) of soils from diseased and com-

Leachate from the top drums runs through plastic tubing to the lower drums in this chlorotic streak transmission experiment.

paratively disease-free fields, (2) of soil sterilization by steam and (3) of surface sterilization of setts. The only transmission occurred in the steam sterilized series of the heavy clay soil from a diseased field but the opportunity was taken to make detailed records of the occurrence of streaks in all diseased material.

A drum experiment in Brisbane included a series containing diseased setts in normal or steam-sterilized soil, leaching to a lower series to such an extent that the latter always had free water present to within a few inches of the surface. The latter contained the same soil as the top series, which had originally been taken from around the base of diseased stools in the field, and also comprised both steam-sterilized and untreated lots. Plantings were made in October, 1959, and symptoms of disease showed abundantly in the top series. The lower series planted to healthy cane had not shown any disease when it was cut in March, 1960. However, within eight weeks of ratooning, 12 shoots, spread over six drums, were showing disease. Subsequently a further six shoots developed disease. It may be significant that the transmission occurred only in drums containing sterilized soil, although the corresponding top drums contained untreated or sterilized soil.

Gravel cultures in painted, galvanized iron troughs holding 30-40 shoots each at Meringa included the following :—(1) diseased and healthy shoots grown in the same troughs, (2) healthy shoots in a trough supplied with drainage water from chlorotic streak diseased fields and (3) controls. All were planted in July-August, 1959, with shooting single-eye setts. Approximately 15 per cent. of the originally healthy shoots developed disease in the plant crop in the mixed troughs and a considerable increase (to over 60 per cent.) in the disease occurred in the ratoons cut either towards the end of October or in December. The trough containing ditch water showed no transmission in either plant or ratoon but the control trough, which contained healthy shoots and had remained free from disease in the plant crop, surprisingly showed nearly 80 per cent. disease in the young ratoons. This experiment was conducted in a semi-open, but roofed, shelter shed and possible factors involved in the transmission are being closely examined.

A preliminary inoculation experiment using inocula from various parts of the plant into several sites has indicated that it may be possible to transmit chlorotic streak by inoculation into the roots.

Ratoon Stunting Disease (Virus)

Internal symptoms of ratoon stunting disease are usually difficult to find during the active cane-growing season, which in North Queensland coincides with the monsoonal rains of the early months of the year; the pink blush characteristic of the diseased immature cane has disappeared and the cane is not sufficiently mature for the development of the discolouration in the nodal vascular bundles. It was unexpected therefore to find that in the Lower Burdekin region, where the discoloured bundles are usually less conspicuous than in any other district, excellent examples of this symptom were present in several varieties on a number of farms in March. The crops were reasonably well advanced for that time, but there was no indication of a premature cessation of growth and ripening. The findings highlight the necessity for regular slicings for the disease through the entire growing period.

Overseas literature has contained several references to the possibility that hot-water treatment of cane plants may produce permanent clonal changes. There has been no evidence of this to date in Queensland but an experiment designed to test it was initiated last spring. Twelve seedlings, which were free from the disease and had never been heat-treated, were subjected to hot water at 50°C for three hours. Plantings from these will be likewise treated over a series of years and careful observations made. It would have been preferable to have used commercial varieties of known field be-

haviour but material fulfilling the requirements was not available.

The variety C.P.36/105, described as a satisfactory indicator cane for ratoon stunting disease by Louisiana workers, was tested but found to be not superior to Q.28 and some other Queensland varieties in the development of internal symptoms of the disease.

The routine, commercial, hot-water treatment of canes for planting was continued in all areas, although in some there has been a change from treatment in the sett to treatment in the stick. Experiments have shown that there is nothing to choose between the two, providing circulation is adequate, and the decision as to which to use depends on local preferences. The addition of urea to the hot-water tank at a concentration of 0.25 per cent. did not have any effect on germination.

Fiji Disease (Virus)

For the first time since records have been kept not a single stool of Fiji disease was found

Fiji disease resistance trials

Variety	Percentage stool infection	Variety	Percentage stool infection
Pindar	8	Q.71	89
Q.57	0	Q.72	62
Q.59	47	Q.73	0
Q.64	97	Standards:	
Q.65	25	C.P.29/116	8– 21
Q.66	15	H.32-8560	85– 100
Q.68	19	M.1900S.	34– 75
Q.69	29	P.O.J.2878	78– 100

Fiji disease can cause a complete loss of crop in susceptible varieties. A trial at the Pathology Farm.

anywhere in commercial plantings in Queensland. It could still be present in the Rocky Point and Moreton areas, since a few diseased stools were found there early in 1959, but elsewhere the disease has not been found for a number of years and apparently has been eliminated.

Two standover Fiji disease resistance trials were harvested at the Pathology Farm in 1959, and inspections have shown a satisfactory development of disease. The figures for commercial varieties are set out in the accompanying Table. The resistance of Q.57 and Q.73 and the susceptibility of Q.59, Q.64, Q.71 and Q.72 may be noted. There is no doubt that the standing over leads to an increase in the amount of disease in the subsequent ratoons, but it poses a problem in that spread to other plantings on the Pathology Farm is more difficult to control than when the Fiji trials are harvested annually.

Mosaic (Virus)

Mosaic disease has been virtually eliminated in some areas in Queensland, in others it is the subject of vigorous campaigns, and yet in others it has been generally reduced to a very low ebb. This was the situation in the Childers area until the finding during the summer of an outbreak in the isolated Booyal district. Only a comparatively small acreage of cane is involved; some heavy infection occurs in Q.50, but some disease also occurs in the less-popular Q.58 and N.Co.310.

Mosaic resistance trial

Variety	Percentage stool infection	Variety	Percentage stool infection
N.Co.310	0	Q.67	90
Q.55	0	Q.68	0
Q.56	0	Q.70	0
Q.57	4	Q.73	0
Q.58	3	Standards	
Q.59	60	Co.290	3
Q.61	0	M.189	100
Q.63	0	Q.28	24
Q.64	80	Q.42	79
Q.65	0	Q.50	20
Q.66	96	Trojan	67

Sorghum verticilliflorum Stapf., growing in close association with cane, also shows the disease and may have been a factor in the development of the outbreak.

Inoculations at the Pathology Farm into a range of local and overseas varieties have not given any positive evidence of the existence of different strains of mosaic in Queensland.

The possibility of inoculating mosaic trials by placing drops of fresh extracts from diseased leaves on the surface exposed by cutting through the spindle a short distance above the growing point was tested in an experiment at the Pathology Farm. The Sein and Matz methods gave almost 100 per cent. infection but the spindle inoculation was a failure.

Results of the resistance trial at the Pathology Farm, which was inoculated by the Sein method in both plant and ratoon crops, are set out in the Table. Seedlings still under test are not included. The varieties Q.59, Q.64, Q.66 and Q.67 are obviously very susceptible to the disease and control might be difficult in them. Mosaic in the other canes listed should not be a problem, providing normal precautions are taken.

A plant trial at the Farm included chiefly seedlings under test but the general susceptibility of Q.66 and probable resistance of Q.72 was indicated.

Leaf Scald

Xanthomonas albilineans (Ashby) Dowson

Although during the past two decades leaf scald has generally been regarded as a disease of the northern, tropical areas in Queensland, it has at one time or another been found in practically every district. Comparatively recent findings have been at Moreton and in a planting of fodder cane near the Queensland-New South Wales border, but the large sugar districts of Bundaberg and Mackay have been apparently free from the disease for a quarter of a century or so. It was therefore somewhat surprising to find infection during autumn, 1960, on a number of farms at Bundaberg and Childers, and

at Mackay and Proserpine. The chief variety involved was Q.63, which has been on the Mackay and Proserpine approved variety lists only since 1958 and has not yet reached that stage at Bundaberg. Symptoms first became obvious during routine inspections in April and May, 1960; by the end of June there were increasing numbers of the acute stage showing and it was apparent that in some fields there had been a great deal of infection which had remained dormant over long periods. Q.63 was known from trial results to be susceptible to the disease but it is not always possible to ascertain from trials the amount of masking to be expected, since it is so dependent on weather conditions, and the development of obvious symptoms of the disease to such an extent could not be forecast.

Cane in leaf-scald trials is cut to give a clean surface for inoculation. The surfaces face south for protection from the sun.

By June 30th, 1960, 15 farms at Bundaberg had been found to be infected, one at Childers, three at Mackay and four at Proserpine. All diseased fields are to be ploughed out after harvest, and Q.63 will not be propagated further at Bundaberg until clean stocks are assured.

In North Queensland, where it was considered that the continued cultivation of the lodging-and flood-resistant Q.66 would be an economic proposition, despite its susceptibility to leaf scald, the expected increase in the disease in planting stocks eventuated. Recourse was therefore had to roguing — the first time this method of control has been used against leaf scald in Queensland — so as to reduce the amount of disease in the variety. Fields showing more than one per cent. diseased stools were abandoned as sources of plants but others were rogued. It is intended also to rogue the crops planted from these.

Laboratory tests indicate that a temperature of 50°C. for 20-30 minutes will kill *Xanthomonas albilineans* suspended either in water or undiluted cane juice but, within the sett, a complete kill is not obtained even by exposure to the standard three-hour treatment at 50°C. The problem of obtaining disease-free material by heat treatment is being further investigated.

The leaf-scald resistance trial at the Pathology Farm was on the usual lines. The trial was inoculated immediately on cutting and the standard susceptible varieties developed a satisfactorily high percentage of infection. The trial included seedlings only and it was noted that N.654 and N.685, which are both seedlings from

H.35-198, continued to show resistance. Three seedlings, 54N6441, 54N7096 and 54N7103, all of which feature Co.475 in their parentage and have shown promise in North Queensland, appeared to be reasonably resistant, although it is possible that 54N7103 may show some masking of the disease. Throughout the trial there was an unusual development of chlorosis and death in the autumn but it is too early for the acute stage at the Pathology Farm to reach its full development.

Bacterial mottle

Pectobacterium carotovorum var. *graminarum*, Dowson and Hayward

Floodings in Queensland were much less during the 1960 wet season than in previous years and as a result, bacterial mottle, which is essentially a disease of flooded lands, was less conspicuous than usual.

Stem galls, multiple buds and side-shooting associated with bacterial mottle.

The illustration shows the stem galls, multiple buds and side shooting, which are often associated with the disease. It is of a stalk of Trojan from a stool arising from an inoculated sett.

Red Rot

Physalospora (*Glomerella*) *tucumanensis* (Speg.) Arx and Muller

Red-rot disease has not generally been of direct economic importance in Queensland during recent years on account of the satisfactory level of resistance of the varieties grown in districts where the disease is likely to be severe. It frequently happens however, that an otherwise desirable cane cannot be grown owing to undue susceptibility; for example, Co.475 was killed outright in South Queensland and could be propagated only in the North. The importance of evaluating the resistance of a new cane before it reaches commercial plantings is obvious, but red-rot resistance trials have hitherto been unreliable. On occasions, a series of trials relying on natural spread of the disease has coincided with years of little spread and susceptible varieties have come through them with no indication of their sensitivity.

Inoculations of cut stalks, as carried out in Louisiana, for instance, have been unsatisfactory. Attempts to improve the trials have included the inoculation of growing stalks with a spore suspension of the causal agent, and in the spring and early summer of 1959 a series of inoculations and slicings at different times was initiated. It included inoculations into the standing cane in late June, late July and early September and slicings for red rot were made in August, October and December.

It would appear that an inoculation in July with an examination in December may give the best results but even so, there were many varieties in the trial which could not be classified

as susceptible or resistant in comparison with the standard canes. Judgment on their resistance will have to await the results of field plantings.

Downy Mildew

Sclerospora sacchari Miy.

Continued inspections in the locality where the last known stool of downy mildew in commercial cane was rogued in the summer of 1957-58 have failed to reveal the disease. Downy mildew has been known to recur after a lapse of several years, so it is not yet certain that the disease has been eliminated.

The resistance trial at the Pathology Farm, which is well isolated from any other plantings of cane, developed a satisfactory amount of disease. It included chiefly seedlings, some of which showed a very high degree of susceptibility. The variety Q.62 is apparently of the same order of susceptibility as P.O.J.2878 and would have to be watched carefully in the presence of the disease.

Yellow spot disease reduces leaf cover and leaves the inter-row space open to the sky

Yellow Spot

Cercospora koepkei Kruger

Yellow spot disease was generally late in developing in the far North in the 1959-60 summer and it was not possible to commence the experimental dustings until March. At Mackay, the early months of 1960 saw a build-up of infection but subsequent conditions were such that the threatened epiphytotic did not eventuate. Normally canes at Mackay, even if susceptible further North, do not suffer losses but, on the other hand, the amount of infection is generally low and the widespread spotting in February was most unusual.

Severe infections in such varieties as Eros and Luna have led to decreased plantings of these canes in the areas north of Townsville and the effects of the disease have also had some influence in the loss of popularity of Trojan. The disease therefore will probably become of less importance in the future, unless susceptible varieties are again introduced, or there is a change in virulence of the organism.

The trial dustings with copper oxychloride gave a considerable reduction in infection and up to three units c.c.s. differences were recorded between dusted and control plots. The dust used was the same as in previous years and, for the first time, showed some toxic effects on the cane leaves. They were confined, however, to stools of Pindar which were showing the unexplained freckling associated with certain northern soils and suspected to be a deficiency of some sort.

Miscellaneous Diseases

A conspicuous yellow blotching on the leaves developed in the variety C.P.52/57 during autumn and winter. It occurred in all the plantings of this newly introduced cane and

although on appearances the disease could have been genetical and therefore harmless, it was decided to destroy all stocks.

An unidentified fungus, which proved to be weakly pathogenic in pot tests, was found associated with a stem and root rot in young cane during the cooler months. It occurred to the greatest extent in the Lower Burdekin district but was also found further north. Q.67 and, to a lesser degree, Trojan were the chief varieties affected. The disease usually first becomes obvious as stooling commences and the first few nodes of cane are being formed. It is apparently confined to primary shoots in plant cane. The leaves develop whitish chimera-like markings with some diffuse red striping towards the base and at the top of the sheaths, and are

Dr. A. Ganguly, Bihar, finds much of interest at the Pathology Farm

Recovery from a fungal rot at the base of the stem sometimes follows adventitious rooting.

An unknown disease characterized by yellowing of the leaves causes a serious stunting of Q.66 at Mossman.

Supervisors from the various Cane Pest and Disease Control Boards inspect a downy mildew trial at the Pathology Farm.

shorter and stiffer than usual. This gives a fan appearance to the top, which is accentuated by the premature death of the older leaves. White mycelium may extend from the point of attachment of the stalk to the original sett to several nodes above ground. Roots are generally rotten and there is a variable amount of invasion of the stem, usually with cankers and collapse of the tissue underlying the rind in the region of the root band. Some stalks may survive by the development of roots from above the affected nodes and these grow normally, but stooling is inhibited or markedly delayed. Affected stools tend to occur in ill-defined patches, both in irrigated and non-irrigated fields.

Quarantine House

A series of wild canes imported by the Colonial Sugar Refining Coy. Ltd. into New South Wales had such narrow leaves that there was a real possibility that the symptoms of mosaic disease, if present, would be so inconspicuous as to be overlooked. The canes were accordingly transferred to the Bureau Quarantine House and concurrent plantings made of the mosaic-susceptible Oramboo and Black Innes (M.189). At a suitable stage juice was extracted from the wild canes and inoculations made by the Matz method into the noble canes. Mosaic disease did not develop in these and, although it was obviously impossible to have suitable controls in the House, it was felt that the importations were free from the disease. The inoculations were supplemented by close examinations of all young shoots.

The Quarantine House is conveniently placed on the roof of the Bureau Head Office and at that site is very well isolated from any commercial cane plantings. Distributions from the House to the Experiment Stations in spring 1959 involved only four varieties viz. B.49377, B.52405, B.52407 and F.137. The subsequent plantings were heavier and some 28 varieties will be distributed shortly.

Legumes

Rhizobium cultures for the inoculation of green manure crops were supplied as usual free of charge to cane growers. The strains involved were tested for effectiveness in a routine trial in the glasshouse.

The soil-borne *Phytophthora drechsleri* Tucker, first reported in Queensland in the summer of 1957, has become firmly established in North Queensland and in the 1959-1960 summer, velvet bean crops were affected in several localities. It would appear that there is little hope of resistance to this wilt in the various strains of velvet beans available but the breeding work with cowpeas should offer a satisfactory alternative green manure.

Schools

The Pathology Division organized two refresher courses during the period under review. They included some lectures at Head Office but the most important features were the inspections and discussions at the Pathology Farm. Supervisors and other staff from the Cane Pest and Disease Control Boards attended the course held during November : the other, in March, included junior Bureau officers. A Senior Pathologist attended a school for members of the Queensland Junior Farmers' Organization held at Mackay in February.

Publications

Publications by members of the Pathology Division are detailed on p. 11 of this report.

Division of Mill Technology

by
J. H. Nicklin, Chief Technologist (Engineer)
and
L. R. Brain, Senior Mill Technologist.

The cooling arrangements for the high grade fugal drives at Millaquin.

Staff

The resignations of two officers were accepted during the year, those of Messrs. R. Deicke and F. Galetto. Mr. P. Stewart completed the post graduate course in sugar technology at the University of Queensland and joined the staff in February. After a short period at Head Office, he was transferred to Bundaberg. Mr. B. G. Adkins was transferred from the Northern Sugar Experiment Station to Bundaberg, bringing the strength of the Technology Division at that Station to four.

Laboratory Work

The number of items of equipment submitted to the Bureau for checking and calibration continue to increase. The following table shows the equipment tested and certified during the past year.

Type of Apparatus	Tested	Certified	N.A.T.A. Certified
Brix Hydrometers ..	548	508	508
Burettes	4	—	—
Flasks, A Class ..	20	20	20
Flasks, B Class ..	243	133	133
Pipettes, A Class ..	7	7	7
Pipettes, B Class ..	76	75	75
Polariscope Tubes ..	47	38	38
Saccharimeters ..	8	5	—
Quartz Control Plates	8	8	—
Refractometers ..	7	6	—
Thermometers	74	68	7
Set of Weights ..	1	1	1

The significant number of items which were tested and were not certified serve to highlight the importance of calibration of equipment. Normally such equipment would find its way into sugar mill laboratories.

It should also be noted that a large proportion of the equipment tested was certified under registration by the National Association of Testing Authorities. During the year, certification was granted to the Mill Technology Laboratory in the field of Heat and Temperature Measurement for the checking of mercury-in-glass thermometers and certification has been requested in the Field of Photometry, i.e., the checking of saccharimeters, refractometers and quartz control plates. It is anticipated that this registration will be granted in the near future. It will be the first registration in this field in Australia.

Four samples of molasses were analysed for the Animal Research Institute and two for a sugar mill.

Investigations of Analysis of Cane

As the major project of the research programme, the cane analysis investigations were pursued to the maximum extent. These investigations are under the direction of the Ministerial committee appointed for the purpose and reports on work carried out are made only to the Minister for Agriculture and Forestry.

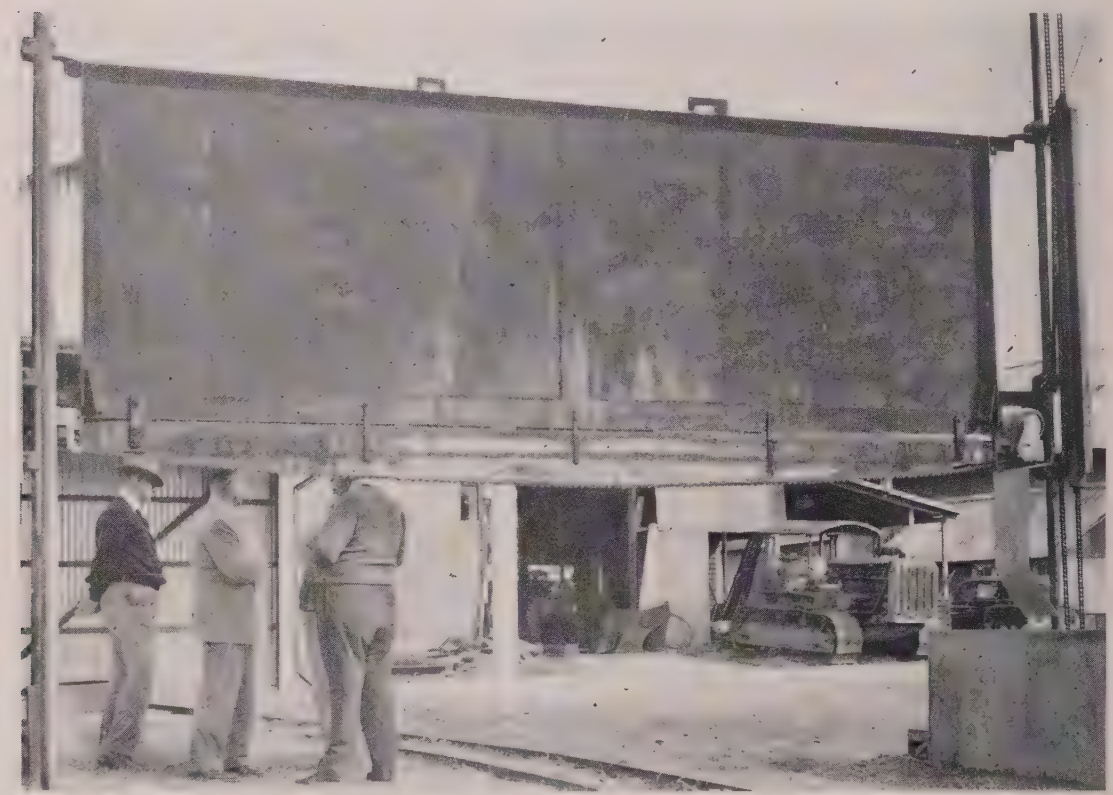
Practically all of the staff are involved in this work, but as mentioned earlier in this Annual Report it is not permissible to publish details of the project at this stage.

Pan Circulation and Steam Consumption

Difficulties with the boiling of C massecuites in some Webre pans in Queensland prompted an investigation at Moreton mill of the velocity of circulation in the tubes of the pan and of the efficiency of the impeller used to circulate the massecuite.

The investigation showed that there was little variation in the circulation rate from the inside to the outside tubes of the calandria but velocities near the steam inlet tended to be higher. The average figures obtained for a number of tests were 7.3 in. per sec. near the steam inlet compared with 6.4 in. per sec. away from the inlet. The steam consumption varied roughly with the velocity of circulation.

In order to test the efficiency of the impeller, three impellers of different design were made in fibreglass to a scale of 1 in 4 and tested with molasses in a model tank. The Webre impeller was compared with two other types, an axial flow unit and a mixed flow unit. At their optimum positions in a centre well, the mixed



Experimental chain saw for sampling of cane at Fairymead mill.

flow impeller proved to be definitely superior to either the Webre or the axial flow impeller in efficiency and maximum head possible.

The work also showed that the position of the Webre impeller is critical and that it is at its optimum position in the pan at Moreton. The performance of the impeller was also better at higher speeds and further work on the pan with the impeller running at 110 r.p.m. rather than the previous 80 r.p.m. is planned.

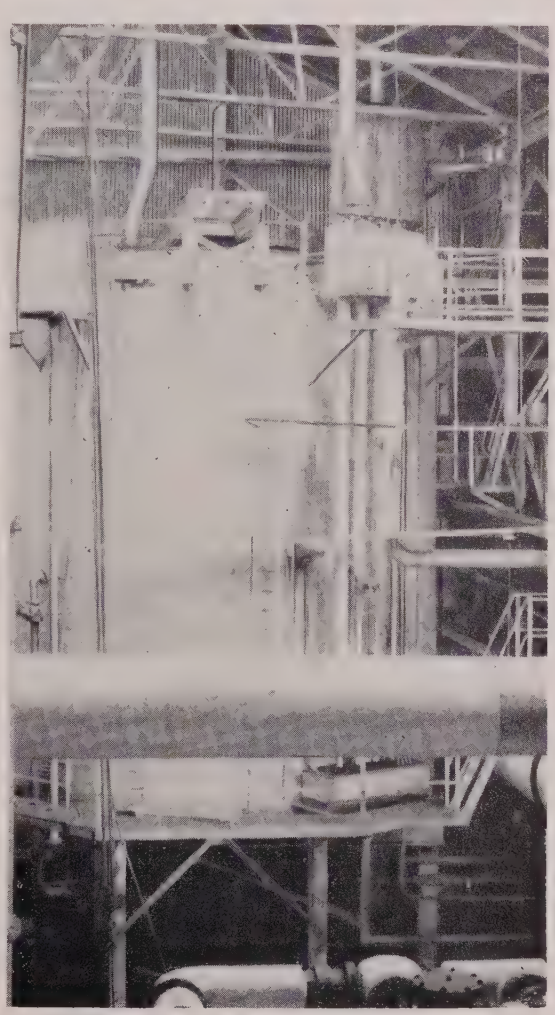
To ensure that the mixed flow impeller is of optimum design, another model or two of this type will be made and tested in the tank. The additional information obtained from these further tests should enable a full size impeller to be designed with reasonable confidence that its efficiency would be about the maximum possible.

The opportunity was taken to check the circulation of the Stewart pan at Moreton, which is a natural circulation calandria pan working on high grade massecuite. Tests carried out on this pan showed that the circulation differed from the Webre in that the average velocity up the inner tubes was about 50 per cent. higher than that up the outer tubes. A single steam inlet is fitted to the Stewart pan and the test tubes were situated on the opposite side of the calandria. It is suggested that incondensible gases might be partially blanketing the outer tubes in this area, causing low heat transfer and consequently reduced velocities. Average figures for a number of tests indicated that the circulation in the Webre tubes was considerably better than that in the Stewart although the lowest velocity measured in the Webre, 2 in. per sec., was slightly less than the lowest velocities noted for the Stewart which were 2.6 and 2.4 in. per sec. for A and B strikes respectively.

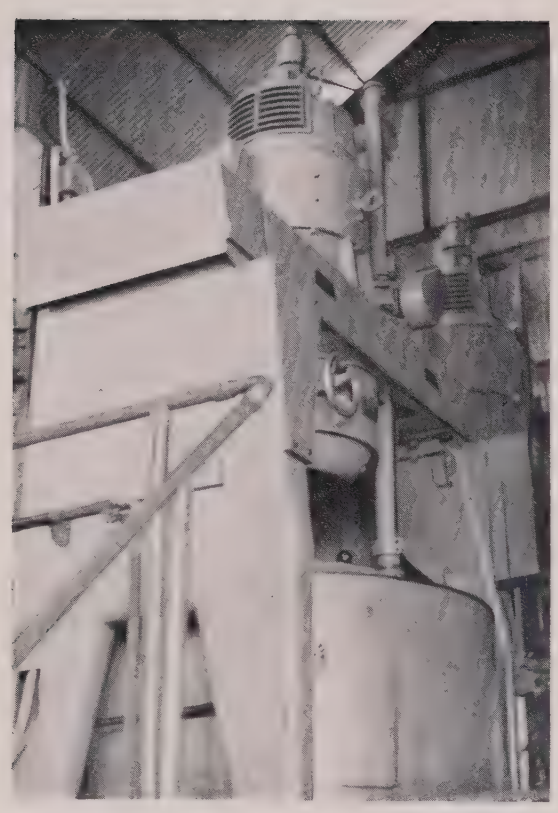
Stability of Juice at Varying pH

While no work was carried out directly on this project, the residence time of juice in a subsider was still open to question in previous work and an attempt was made to determine this factor. Several methods for determining residence time were studied but the use of radioisotopes was considered to be most suitable. In conjunction with the Australian Atomic Energy Commission, a test was conducted on the Bach subsider at Qunaba mill. The radioisotope, bromine 82, was introduced into the flash tank and it was later detected at the outlets from each of the trays.

This work indicated that while the theoretical residence time was 1½ hours at Qunaba, activated juice made its appearance at the outlet in 5 to



The new Dorr subsider at Fairymead.



Modern automatic fugal station for handling low grade massecuite at Gin Gin mill.

10 minutes. Extensive mixing of juices occurred during subsidation and consequently the reliability of samples taken before and after passage through a subsider must be very doubtful.

Apart from information on the residence time, this experiment produced valuable information on the flow pattern of juice within the subsider. Following consultation with the makers of subsiders, further work may be carried out with radioisotopes.

The test also proved that radioisotopes can be used safely for experimental work in sugar mills provided that they are handled by responsible personnel. There was no health hazard to workers in the mill during the test at Qunaba.

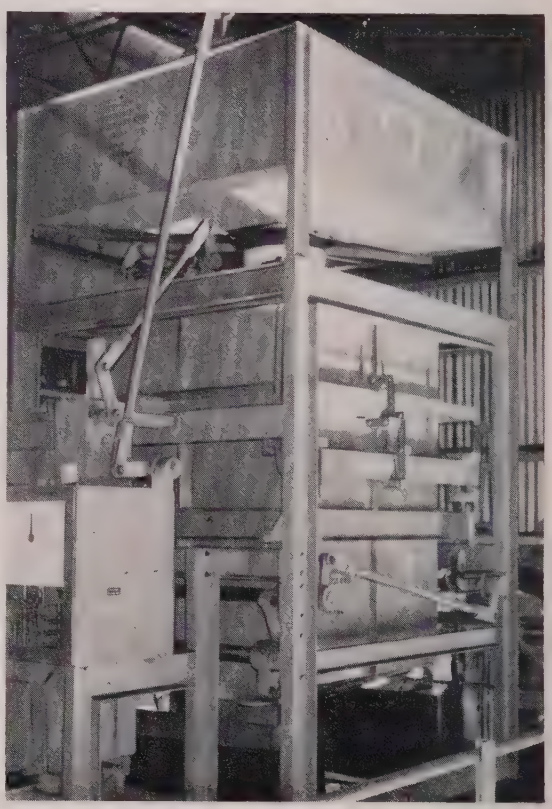
Hardboard from Bagasse

A number of low density boards were made by the Monsanto Chemical Co., the bagasse being lightly hammermilled and the very fine fraction removed prior to the board-making. The boards should be quite suitable for use as corestock in the manufacture of veneered panels.

Both high density and low density hardboard can be made from bagasse with no technical difficulty. However, the market requirements would govern the economics of an undertaking to manufacture bagasse hardboards. It now appears that the most promising use for surplus bagasse would be in the manufacture of low density boards for corestock.

The 1959 Season

Following the record sugar production of the 1958 season, individual mills were limited to



The Servo Balans juice weigher recently installed at Millaquin mill.

their peaks in 1959 with an allowable over-production of one half per cent.. A considerable quantity of cane was thereby left in the field and the full effect of over-production was consequently felt throughout the industry. Actually 1,217,020 tons of 94 n.t. sugar were produced in Queensland from 8,427,731 tons of cane. Thus only 6.92 tons of cane were required for each ton of sugar, the lowest figure recorded for many years. As will be discussed later, this low figure was due to both an increase in the quality of the cane milled and also in factory efficiency.

Climatic conditions were excellent for cane growth during the 1959 season and the quality of cane was the highest recorded since 1944. The c.c.s. of 14.56 was 0.48 higher than that recorded in 1958. While a slight rise was recorded in the northern district, very significant rises occurred in the Burdekin, Mackay and Southern districts. Continuing a trend which has been in evidence for the past few years, the fibre per cent. cane decreased to 12.95. An awareness of the ill-effects of extraneous matter in overall industry economics and the consequent better control in the field combined to keep the cane relatively clean and reduce the fibre content.

In a very short season which included only 4394 crop days, the percentage of the total time available for crushing dropped from 72.98 to 70.48. Lost time due to manufacture decreased while that due to cane supply rose due to some rain and labour shortage.

Crushing rates continued to increase, the average rate for 1959 being 114.59 tons of cane per hour. Rocky Point is included in this figure for the first time with a consequent depression of the average and it is therefore not strictly comparable with the crushing rate recorded in 1958. Only minor improvements were made to milling trains in the mills and the increased rate is therefore commendable. Combined with this crushing rate was a significant rise in pol extraction from 94.57 to 95.00. The northern and Mackay districts recorded good increases in extraction while the Burdekin and southern areas showed little change.

The purity of final molasses increased in all districts in 1959, the greatest increase being recorded in the Burdekin district. However, the average molasses purity of 43.68 must be viewed by comparison with the expected purity of 41.14 and the difference has shown no change from that of 1958. The expected purity increased with a reduction in reducing sugar-ash ratio in each district. Due to a high initial purity of juice, the quantity of molasses declined which fact more than compensated for the rise in purity.

Overall factory performance was outstanding in 1959 both coefficient of work and overall recovery registering significant gains. The average coefficient of work increased from 98.20 to 98.60 while the overall recovery rose from 86.70 to 87.95. Pol losses in bagasse, molasses and mud all decreased as did the undetermined loss; the general standard of factory operation obviously improved even at the higher crushing rates.

The quality of sugar showed a slight decline, the net titre decreasing to 96.79 and the dilution indicator increasing to 34.4.

Both the total fuel and the added fuel showed a decrease in 1959, showing that plant control in the mill extended to the boiler station. It should be realised, of course, that the bagasse used is not a real measure of that necessary for steam production as many mills have a surplus of bagasse and others burn it inefficiently to avoid a surplus.

The overall results of the 1959 season were very pleasing in that cane of high quality was processed at a high rate and a high standard of efficiency. There appears to be little chance of substantial increases in mill peaks in the near future and production will be restricted to these peaks, except for occasional shortfalls which may benefit the Queensland industry. Therefore progress in the efficiency with which cane can be milled is of the utmost importance and it does appear that mill personnel are already actively engaged in improving milling and processing figures.

Table IX Production Data for Queensland Mills for Seasons 1953-1959 (Totals and weighted Averages)

Northern District	1953	1954	1955	1956	1957	1958	1959
Cane—							
Tons	3,315,716	3,943,427	3,270,354	3,197,051	3,699,279	3,882,644	3,461,833
Pol per cent.	15.45	13.88	13.55	13.80	14.74	15.07	14.83
Fibre per cent.	11.61	10.93	11.38	11.74	11.21	11.20	11.20
C.c.s.	14.48	12.70	12.36	12.67	13.99	14.06	14.15
Purity 1st expressed juice	89.96	87.20	86.96	87.71	89.11	89.07	89.72
Sugar—							
Tons 94 net titre	467,716	502,276	413,853	406,172	516,345	540,476	485,660
Cane per ton sugar	7.09	7.85	7.90	7.87	7.16	7.18	7.13
Pol per cent.	98.81	98.50	98.60	98.78	98.66	98.36	98.40
Net titre	97.52	97.09	97.33	97.61	97.30	96.67	96.58
Dilution indicator	31.0	30.5	41.0	38.5	36.0	37.3	38.7
Pol per cent. pol cane	85.78	85.17	84.67	86.32	87.69	87.17	87.22
Mud—							
Tons	55,582	63,816	54,285	53,324	57,489	57,210	50,508
Mud per cent. cane	2.95	2.96	3.07	3.19	2.90	2.72	2.64
Pol per cent.	3.55	2.96	3.47	2.40	2.54	2.05	2.12
Pol per cent. pol cane pol	0.69	0.64	0.79	0.55	0.50	0.37	0.38
Molasses—							
Gallons (1,000's)	7,723	10,246	8,243	7,416	8,001	8,981	7,353
Gallons per ton cane	4.17	4.76	4.66	4.43	4.04	4.28	3.85
Brix	89.87	89.78	91.38	90.29	90.60	90.58	90.66
Apparent purity	33.97	32.49	31.87	30.05	30.76	29.16	30.77
True purity	45.71	44.31	44.40	41.82	42.77	41.67	42.94
Expected purity	38.90	38.0	38.4	37.8	38.34	37.58	38.97
Reducing sugars/ash	..	..	1.90	2.12	1.87	2.23	1.66
Pol per cent. pol cane	5.62	6.74	6.79	5.76	5.06	4.96	4.80
Final Bagasse—							
Tons	446,918	489,784	421,275	404,825	461,292	490,452	441,466
Bagasse per cent. cane	24.24	22.74	23.83	24.19	23 30	23.35	23.11
Pol per cent.	3.03	2.63	2.55	2.37	2.99	3.38	3.01
Dry substance	51.63	51.55	51.39	51.69	52.08	52.02	52.64
Pol per cent. pol cane	4.73	4.31	4.48	4.15	4.72	5.24	4.69
Undetermined loss—							
Pol per cent. pol cane	3.18	3.14	3.47	3.22	2.03	2.26	2.91
Fuels—							
Tons: Wood	5,181	3,498	4,909	9,691	6,300	5,899	6,392
Coal	0	40	42	111	71	96	175
Molasses	1,206	6,982	9,093	9,183	1,842	736	1,317

Burdekin District	1953	1954	1955	1956	1957	1958	1959
Cane—							
Tons	1,306,587	1,503,156	1,255,985	1,303,889	1,382,125	1,387,269	1,206,774
Pol per cent.	16.34	15.84	15.87	15.50	16.35	15.89	16.45
Fibre per cent.	11.79	11.55	11.67	12.40	12.15	11.70	12.11
C.c.s.	15.30	14.71	14.70	14.45	15.21	14.72	15.22
Purity first expressed juice	89.32	89.23	88.76	89.70	89.77	88.91	89.05
Sugar—							
Tons 94 net titre	193,483	218,505	179,664	184,607	208,250	204,812	182,211
Cane per ton sugar	6.75	6.88	6.99	7.06	6.64	6.77	6.62
Pol per cent.	98.87	98.82	98.65	98.72	98.52	98.83	98.80
Net titre	97.19	97.23	96.96	96.93	96.38	96.92	96.74
Dilution indicator	27.5	29.5	35.0	31.0	32.4	31.3	30.8
Pol per cent. pol cane	86.59	87.65	86.20	87.47	88.56	89.03	88.12
Mud—							
Tons	46,711	54,491	44,066	46,074	52,525	59,486	47,833
Mud per cent. cane	3.17	3.63	3.51	3.53	3.80	4.29	3.96
Pol per cent.	2.32	2.07	1.82	1.87	1.83	1.59	1.78
Pol per cent. pol cane	0.51	0.47	0.40	0.43	0.43	0.43	0.43
Molasses—							
Gallons (1,000's)	6,204	6,652	5,761	5,623	6,143	6,169	5,782
Gallons per ton cane	4.75	4.43	4.59	4.31	4.44	4.45	4.79
Brix	90.11	91.84	91.10	91.31	92.31	90.05	91.08
Apparent purity	35.26	34.93	34.94	35.76	34.54	32.78	34.03
True Purity	46.97	45.22	44.62	45.24	44.21	42.47	43.91
Expected purity	40.61	41.19	41.03	41.06	41.83	41.01	41.33
Reducing sugars ash	..	..	1.19	1.15	0.99	1.20	1.11
Pol per cent. pol cane	5.88	6.12	6.18	6.04	5.79	5.46	6.00
Final Bagasse—							
Tons	312,937	340,976	294,263	312,732	331,460	318,499	290,011
Bagasse per cent. cane	23.95	22.68	23.43	23.98	23.98	22.96	24.03
Pol per cent.	3.31	3.08	3.17	2.77	3.19	3.13	3.22
Dry substance	53.93	53.87	53.55	55.28	54.68	54.97	54.50
Pol per cent. pol cane	4.85	4.49	4.69	4.30	4.68	4.53	4.71
Undetermined Loss—							
Pol per cent. pol cane	2.17	1.27	2.53	1.76	0.54	0.55	0.74
Fuels—							
Tons: Wood	2,756	2,124	2,150	3,521	1,837	928	704
Coal	130	69	39	353	0	233	0
Molasses	0	0	0	0	238	0	0

Table IX—continued.

Mackay District	1953	1954	1955	1956	1957	1958	1959
Cane—							
Tons	2,467,243	2,616,619	2,386,011	2,462,019	2,702,060	2,563,034	2,083,692
Pol per cent.	15.85	14.94	15.40	14.84	15.46	15.43	16.22
Fibre per cent.	13.42	14.40	15.12	15.02	14.77	14.53	14.32
C.c.s.	14.71	13.87	14.22	13.71	14.33	14.29	15.17
Purity first expressed juice	88.56	89.54	88.85	88.97	89.60	89.28	90.72
Sugar—							
Tons 94 net titre	354,165	352,362	329,482	323,631	378,793	359,112	315,391
Cane per ton sugar	6.97	7.43	7.24	7.61	7.13	7.14	6.61
Pol per cent.	99.01	98.97	98.86	98.88	98.68	98.71	98.71
Net titre	97.97	97.79	97.57	97.59	97.04	97.07	96.93
Dilution indicator	30.5	26.8	34.3	33.9	29.7	32.6	32.7
Pol per cent. pol cane	86.06	85.74	85.40	84.34	86.70	86.77	89.31
Mud—							
Tons	87,182	90,671	84,049	90,763	103,938	97,889	73,997
Mud per cent. cane	3.65	3.47	3.52	3.69	3.85	3.82	3.55
Pol per cent.	3.28	2.91	2.92	2.72	2.83	2.91	2.87
Pol per cent. pol cane	0.74	0.68	0.66	0.67	0.70	0.72	0.63
Molasses—							
Gallons (1,000's)	12,486	11,575	11,917	10,592	10,456	10,370	8,014
Gallons per ton cane	5.06	4.42	4.99	4.30	3.87	4.05	3.85
Brix	89.57	89.17	90.86	89.73	90.85	90.24	90.55
Apparent purity	34.31	36.07	34.53	36.25	34.10	33.32	33.13
True purity	43.41	43.60	42.89	43.53	41.92	41.29	41.59
Expected purity	39.42	40.45	39.99	40.25	40.62	40.04	40.50
Reducing sugars/ash	..	..	1.40	1.32	1.26	1.42	1.31
Pol per cent. pol cane	6.28	5.92	6.33	6.22	5.15	5.22	4.71
Final Bagasse—							
Tons	697,410	775,206	757,762	785,458	834,597	773,958	597,019
Bagasse per cent. cane	28.27	29.63	31.76	31.90	30.89	30.20	28.65
Pol per cent.	2.97	2.70	2.76	2.60	2.91	2.97	2.81
Dry substance	51.31	52.14	51.41	51.17	51.51	51.89	53.81
Pol per cent. pol cane	5.25	5.35	5.70	5.60	5.81	5.81	4.96
Undetermined Loss—							
Pol per cent. pol cane	1.67	2.31	1.91	3.17	1.64	1.48	0.39
Fuels—							
Tons: Wood	4,229	1,470	1,903	2,852	1,136	1,505	859
Coal	51	12	0	50	114	0	14
Molasses	0	0	0	0	0	0	0

Southern District	1953	1954	1955	1956	1957	1958	1959
Cane—							
Tons	1,661,517	1,801,103	1,703,813	2,015,122	1,162,153	1,907,848	1,675,432
Pol per cent.	13.82	14.08	14.12	14.29	14.91	14.60	15.26
Fibre per cent.	13.52	14.77	14.70	14.17	14.61	14.09	13.85
C.c.s.	12.51	12.91	12.89	13.12	13.68	13.38	14.17
Purity first expressed juice	85.90	87.80	87.22	87.81	87.90	88.03	89.38
Sugar—							
Tons 94 net titre	205,019	228,102	212,676	257,460	152,883	249,143	233,758
Cane per ton sugar	8.10	7.90	8.01	7.83	7.60	7.66	7.17
Pol per cent.	98.90	99.00	98.83	98.57	98.49	98.74	98.79
Net titre	97.51	97.68	97.26	96.64	96.44	96.88	96.88
Dilution indicator	29.6	32.8	35.9	34.8	33.5	32.0	33.3
Pol per cent. pol cane	85.03	85.82	84.58	85.75	84.92	85.81	87.66
Mud—							
Tons	57,018	65,650	61,903	71,324	44,428	70,727	64,289
Mud per cent. cane	3.47	3.70	3.69	3.59	3.92	3.81	3.84
Pol per cent.	2.67	2.73	2.91	3.08	2.89	2.75	2.74
Pol per cent. pol cane	0.67	0.72	0.76	0.77	0.76	0.72	0.69
Molasses—							
Gallons (1,000's)	7,678	7,248	7,708	8,117	5,117	8,225	6,270
Gallons per ton cane	4.67	4.09	4.59	4.09	4.52	4.43	3.74
Brix	91.71	91.57	91.84	91.99	91.51	91.45	91.37
Apparent purity	32.75	36.13	36.10	36.62	37.57	36.13	37.10
True purity	41.74	43.00	44.38	45.00	45.55	44.94	45.46
Expected purity	40.40	42.00	42.60	42.8	42.39	42.29	42.83
Reducing sugars/ash	..	..	0.88	0.90	0.90	0.93	0.81
Pol per cent. pol cane	6.54	6.42	7.34	6.42	6.94	6.66	5.52
Final Bagasse—							
Tons	477,531	567,691	518,682	588,925	355,219	544,456	479,739
Bagasse per cent. cane	29.17	32.00	30.91	29.66	31.37	29.30	28.63
Pol per cent.	2.46	2.41	2.45	2.78	2.72	2.61	2.67
Dry substance	49.46	49.29	50.73	50.89	50.06	51.29	51.71
Pol per cent. pol cane	5.19	5.48	5.35	5.77	5.72	5.24	5.01
Undetermined Loss—							
Pol per cent. pol cane	2.57	1.56	1.90	1.29	1.66	1.57	1.12
Fuels—							
Tons: Wood	4,774	4,595	4,332	2,693	3,374	2,998	1,808
Coal	519	308	108	99	152	131	18
Molasses	0	0	0	0	0	0	0

Table IX—continued.

All Queensland Districts	1953	1954	1955	1956	1957	1958	1959
Cane—							
Tons	8,751,063	9,864,305	8,616,163	8,978,081	8,945,617	9,740,795	8,427,731
Pol per cent.	15.38	14.64	14.72	14.58	15.34	15.22	15.64
Fibre per cent.	12.69	13.02	13.48	13.59	13.26	13.05	12.95
C.c.s.	14.26	13.50	13.53	13.45	14.24	14.08	14.56
Purity first expressed juice	88.45	88.47	87.97	88.49	89.21	88.90	89.82
Sugar—							
Tons 94 net titre	1,220,383	1,301,245	1,135,675	1,171,870	1,256,271	1,353,543	1,217,020
Cane per ton sugar	7.17	7.58	7.59	7.66	7.12	7.20	6.92
Pol per cent.	98.91	98.83	98.75	98.75	98.61	98.65	98.66
Net titre	97.61	97.47	97.33	97.22	96.88	96.89	96.79
Dilution indicator	29.9	29.9	36.5	35.0	32.5	33.8	34.4
Pol per cent. pol cane	85.88	86.00	85.20	85.72	87.07	87.07	88.15
Mud—							
Tons	246,493	274,628	244,303	261,485	258,380	285,312	236,627
Mud per cent. cane	3.36	3.41	3.45	3.52	3.59	3.61	3.44
Pol per cent.	3.02	2.71	2.84	2.60	2.57	2.42	2.46
Pol per cent. pol cane	0.67	0.63	0.66	0.63	0.60	0.57	0.54
Molasses—							
Gallons (1,000's)	34,091	35,721	33,629	31,748	29,717	33,745	27,419
Gallons per ton cane	4.69	4.44	4.74	4.28	4.13	4.27	3.99
Brix	90.22	90.34	91.25	90.72	91.20	90.59	90.88
Apparent purity	34.05	34.84	34.31	34.81	33.89	32.80	33.60
True purity	44.20	43.98	43.90	43.80	43.25	42.50	43.33
Expected purity	39.70	40.20	40.40	40.4	40.56	40.11	40.80
Reducing sugars/ash	..	..	1.32	1.30	1.26	1.40	1.21
Pol per cent. pol cane	6.09	6.28	6.63	6.14	5.53	5.52	5.16
Final Bagasse—							
Tons	1,934,796	2,173,657	1,991,982	2,091,940	1,982,568	2,127,365	1,808,235
Bagasse per cent. cane	27.03	27.01	28.10	28.18	27.55	26.90	26.30
Pol	2.91	2.67	2.69	2.63	2.94	3.00	2.89
Dry substance	51.35	51.53	51.54	51.81	51.91	52.23	53.08
Pol per cent. pol cane	5.03	4.94	5.15	5.09	5.28	5.30	4.85
Undetermined Loss—							
Pol per cent. pol cane	2.53	2.15	2.38	2.42	1.52	1.54	1.30
Fuels—							
Tons: Wood	16,940	11,687	13,294	18,757	12,647	11,330	9,763
Coal	700	1,152	189	613	337	460	207
Molasses	1,206	6,982	9,093	9,183	2,080	736	1,317

Tons of cane, tons of sugar, tons of cane per ton of sugar and c.c.s. (1957, 1958 and 1959 only), include all mills. All other figures exclude C.S.R. and Rocky Point Mills. (Rocky Point figures included 1959).

Table X

Tons of Cane per Ton 94 Net Titre Sugar, 1950-1959

Season	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
Tons Cane per ton 94 n.t. Sugar	7.61	7.11	7.32	7.17	7.58	7.59	7.66	7.12	7.20	6.92

Table XI

Sugar Produced in Districts, 1959 Season, with Peak Allocations

Districts	Tons 94 Net Titre Sugar			Production per cent. Peak
	Produced	Peak	Excess Production over Peak	
Northern	485,660	485,400	+ 260	100.05
Burdekin	182,211	181,700	+ 511	100.28
Mackay	315,391	313,400	+1,991	100.64
Southern	233,758	232,500	+1,258	100.54
All Districts	1,217,020	1,213,000	+4,020	100.33

Table XII

Figures for 1959 Season (Totals and Arithmetic Averages)

—	Northern	Burdekin	Mackay	Southern	All Districts
Tons Cane Crushed	3,461,833	1,206,774	2,083,692	1,675,432	8,427,731
Tons 94 N.T. Sugar made	485,660	182,211	315,391	233,758	1,217,020
Net Titre of Sugar	96.62	96.68	96.92	96.82	96.79
Tons Cane per ton 94 N.T. Sugar	7.19	6.60	6.61	7.21	6.97
C.c.s. of Cane	14.11	15.26	15.19	14.21	14.56
Coefficient of Work	97.92	99.32	99.72	97.73	98.60
Coefficient of Work E.S.G.	93.33	95.00	95.08	93.37	94.11
Crushing Rate	129.05	119.27	126.67	92.14	114.59
Lost Time per cent. Available Time	11.89	5.32	3.57	7.04	6.83
Fibre of Cane	11.18	12.34	14.26	13.93	13.18
Pol of Cane	14.87	16.47	16.24	15.29	15.65
First Expressed Juice					
Brix	19.76	22.34	22.17	21.06	21.29
Purity	89.81	89.21	90.72	89.58	89.91
Purity—					
Clarified Juice	88.77	87.91	89.81	88.94	89.01
Syrup	89.13	88.25	89.64	89.01	89.11
Dilution per cent. First Expressed Juice	23.86	31.44	32.02	35.02	31.12
Final Bagasse—					
Pol	2.99	3.22	2.82	2.80	2.91
Dry Substance	52.72	54.45	53.61	51.79	52.93
Pol Extraction	95.33	95.19	95.01	94.69	95.00
Reduced Extraction	94.72	95.14	95.71	95.33	95.28
Final Molasses—					
Gallons per ton Cane	3.83	4.81	3.86	3.75	3.96
Brix	90.43	90.74	90.43	90.19	90.40
Apparent Purity	30.85	34.28	33.04	37.34	34.17
True Purity	42.90	44.25	41.63	45.77	43.68
Expected Purity	39.12	41.05	40.63	42.99	41.14
Reducing Sugars/Ash	1.64	1.18	1.30	0.80	1.19
Final Mud—					
Per cent. Cane	2.60	3.74	3.72	3.94	3.55
Pol per cent. Mud	2.17	1.70	2.79	2.80	2.49
Sugar—					
Pol	98.42	98.76	98.70	98.77	98.67
Reducing Sugars	0.44	0.30	0.36	0.25	0.33
Ash	0.27	0.36	0.28	0.34	0.31
Moisture	0.44	0.30	0.32	0.32	0.34
Dilution Indicator	38.8	31.3	32.8	34.3	34.4
Pol Balance—					
Sugar (Recovery)	87.24	88.33	89.27	87.08	87.95
Bagasse Loss	4.67	4.81	4.99	5.31	5.00
Molasses Loss	4.77	6.03	4.71	5.48	5.17
Mud Loss	0.37	0.40	0.64	0.71	0.57
Undetermined Loss	2.95	0.43	0.39	1.42	1.31
Recovery overall E.S.G.	86.83	87.99	88.92	86.75	87.60
Recovery on mixed juice	91.51	92.79	93.96	91.95	92.57
Recovery on mixed juice E.S.G.	91.09	92.43	93.58	91.61	92.20
Boiling House Efficiency	95.87	97.51	97.96	96.45	96.93
Boiling House Efficiency E.S.G.	95.43	97.14	97.58	96.09	96.54
Fuels (as equivalent Bagasse per cent. Cane)—					
Wood	0.64	0.16	0.09	0.25	0.28
Coal	0.03	0.00	0.00	0.00	0.01
Molasses	0.11	0.00	0.00	0.00	0.02
Total added	0.78	0.16	0.09	0.25	0.31
Bagasse	24.74	27.39	31.47	30.28	28.97
Total Fuel	25.52	27.55	31.56	30.53	29.28
Crop Days	1,681	614	978	1,121	4,394

Tons of cane, tons of sugar, tons of cane per ton of sugar, c.c.s. of cane and crop days include all mills. All other figures exclude C.S.R. mills.

Table XIII
Cane Milled and Sugar Yielded, 1959 Season

Mills	Tons Cane Crushed	*Tons 94 n.t. Sugar made	Tons Cane per ton Sugar	
			1959	1958
Mossman	217,208	31,000	7.007	7.135
Hambledon	329,736	47,439	6.951	6.935
Mulgrave	350,894	47,845	7.334	7.222
Babinda	359,441	46,427	7.742	7.446
Goondi	285,491	38,126	7.488	7.177
Mourilyan	255,532	34,038	7.496	7.247
South Johnstone	356,601	48,695	7.323	7.220
Tully	370,552	50,021	7.408	7.374
Victoria	601,185	90,095	6.673	7.104
Macknade	335,193	51,923	6.456	7.071
Northern District Totals and Averages	3,461,833	485,660	7.128	7.184
Invicta	176,051	27,059	6.506	6.750
Pioneer	307,500	47,244	6.509	6.798
Kalamia	325,247	49,042	6.632	6.686
Inkerman	397,976	58,866	6.761	6.838
Burdekin District Totals and Averages	1,206,774	182,211	6.623	6.773
Proserpine	316,946	45,339	6.991	7.260
Farleigh	295,623	44,248	6.681	7.218
Racecourse	289,501	44,392	6.521	7.007
Pleystowe	288,313	45,335	6.360	6.991
Marian	282,381	42,163	6.697	7.344
Cattle Creek	161,335	23,483	6.870	7.345
North Eton	166,026	26,152	6.349	6.963
Plane Creek	283,567	44,279	6.404	7.019
Mackay District Totals and Averages	2,083,692	315,391	6.607	7.137
Fairymead	267,169	37,690	7.089	7.660
Qunaba	137,006	19,601	6.990	7.435
Millaquin	254,066	37,210	6.828	7.368
Bingera	279,425	39,236	7.122	7.571
Gin Gin	108,001	14,816	7.289	8.482
Isis	297,005	39,463	7.526	7.957
Maryborough	145,046	20,041	7.237	7.794
Moreton	145,713	20,188	7.218	7.398
Rocky Point	42,001	5,513	7.619	8.138
Southern District Totals and Averages	1,675,432	233,758	7.167	7.658
All Districts Totals and Averages	8,427,731	1,217,020	6.924	7.197

*Local Sales included.

TABLE XIV
Analysis of Gross Time, 1959 Season, excluding C.S.R.

	Total Hours	Per Cent. Gross Total Hours	Per Cent. of Available Hours
Crushing Time	58,566.06	65.57	93.03
Lost Time—			
Manufacture	2,142.96	2.40	3.40
Cane Supply	2,245.28	2.51	3.57
Total Available Hours	62,954.30	70.48	100.00
Premeditated and Week-end Stops	26,372.42	29.52	
Gross Total Hours	89,326.72	100,00	

Table XV

***Fuels Calculated as Equivalent Bagasse Per Cent. Cane, 1953-1959**
(Arithmetic Averages)

Year	Wood	Coal, etc.	Molasses	Total Added	Bagasse	Total Fuel
NORTHERN DISTRICT						
1953	0.562	..	0.111	0.673	25.413	26.086
1954	0.308	0.008	0.434	0.750	23.952	24.702
1955	0.550	0.010	0.627	1.187	24.945	26.132
1956	1.057	0.025	0.777	1.859	25.402	27.261
1957	0.597	0.011	0.125	0.733	24.753	25.487
1958	0.540	0.017	0,045	0.602	24.618	25.220
1959	0.637	0.035	0.110	0.782	24.740	25.522
BURDEKIN DISTRICT						
1953	0.493	0.033	..	0.526	27.118	27.644
1954	0.308	0.015	..	0.323	25.455	25.778
1955	0.380	0.010	..	0.390	26.163	26.553
1956	0.553	0.090	..	0.643	27.523	28.166
1957	0.330	..	0.040	0.370	27.505	27.875
1958	0.123	0.055	..	0.178	26.530	26.708
1959	0.160	..	..	0.160	27.393	27.553
MACKAY DISTRICT						
1953	0.293	0.010	..	0.303	28.943	29.246
1954	0.115	0.001	..	0.116	31.401	31.517
1955	0.164	..	..	0.164	32.895	33.059
1956	0.213	0,006	..	0.219	32.961	33.180
1957	0.083	0.013	..	0 095	32.188	32.283
1958	0.123	..	..	0.123	31.618	31.741
1959	0.091	0.004	..	0.095	31.470	31.565
SOUTHERN DISTRICT						
1953	0.956	0.078	..	1.034	29.309	30.343
1954	0.845	0.044	..	0.889	31.767	32.656
1955	0.774	0.017	..	0.791	31.980	32.771
1956	0.378	0.012	..	0.390	30.806	31.196
1957	1.480	0.036	..	1.516	31.473	32.989
1958	0.425	0.021	..	0.446	30.598	31.044
1959	0.248	0.003	..	0.251	30.284	30.535
ALL QUEENSLAND DISTRICTS						
1953	0.589	0.032	0.026	0.647	27.960	28.607
1954	0.414	0.018	0.100	0.532	28.880	29.412
1955	0.474	0.009	0.145	0.628	29.743	30.371
1956	0.510	0.025	0.179	0.714	29.717	30.431
1957	0.669	0.017	0.035	0.722	29.532	30.253
1958	0.312	0.019	0.010	0.341	28.906	29.247
1959	0.275	0.010	0.024	0.309	28.975	29.284

*Excluding C.S.R. mills.

Table XVI

Total Crop Days, All Mills, 1950-59

——	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
Total Crop Days ..	6,469	4,089	5,046	5,515	6.110	5,397	5,605	4,690	4,990	4,394

Average Crushing Rates, 1950-59, excluding C.S.R. and Rocky Point Mills (1950-58) Rocky Point included 1959. (Arithmetic Averages)

——	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
Tons Cane per hour	72.35	71.47	78.28	87.15	93.51	97.20	102.25	109.46	113.99	114.59

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